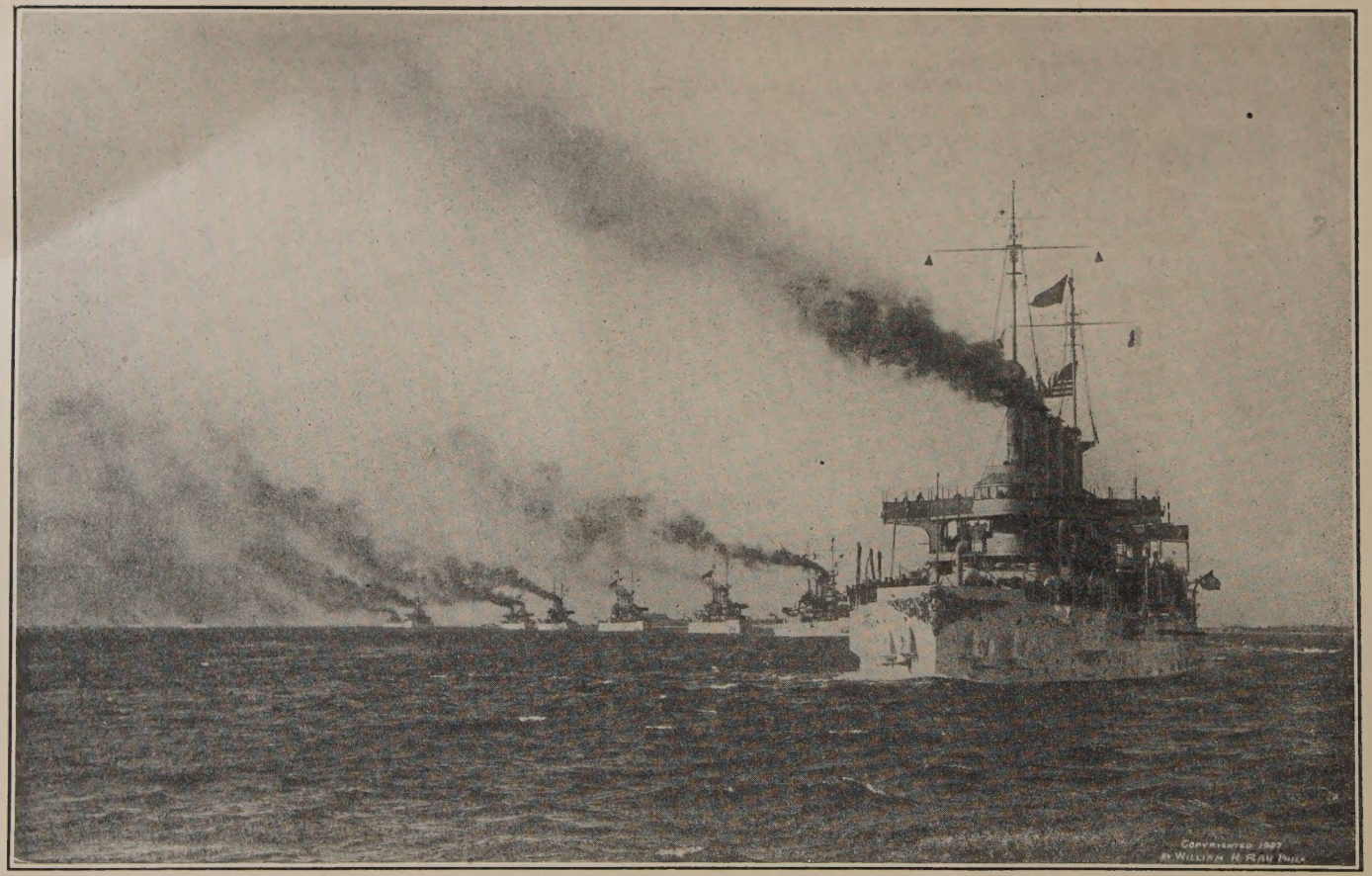
Pearlman Memorial Library
Central Bible College
Springfield, Missouri



Copyright. 1907, Wm. H. Rau.

THE AMERICAN FLEET BRINGING SUCCOR.

We thrill with pride to think that we have always been first in taking aid to the unfortunate and standing by the afflicted. The American fleet, which was sailing through the Suez Canal, was instructed to sail immediately to the scene of destruction and to give its stores to the unfortunate victims. The dreadfulness of this calamity and the universal sympathy it aroused is emphasized by the fact that the United States Congress also appropriated $800,000 in cash

Morris's Story of the Great Earthquake of 1908

AND OTHER HISTORIC DISASTERS

EMBRACING TWO BOOKS IN ONE VOLUME

BOOK I.

CONTAINS A COMPLETE AND ACCURATE ACCOUNT OF THE GREAT ITALIAN AND SICILIAN EARTHQUAKE AND TIDAL WAVE OF 1908, one of the most fearful disasters nature ever visited upon the human race, in which more lives were lost, in a few ill-fated minutes, than Russia lost in battle during her war with Japan.

A compendium of thrilling accounts given by eye-witnesses who escaped death, and those engaged in the noble work of relief, the whole being a picture of tragic pathos, before which civilization stands in fascinated awe. Pompeii of old, and San Francisco's great disaster pale into insignificance beside its frightful loss of life.

BOOK II.

INCLUDES A GRAPHIC STORY OF ALL GREAT EARTHQUAKES AND VOLCANIC ERUPTIONS IN THE WORLD'S HISTORY, TOGETHER WITH SCIENTIFIC EXPLANATIONS OF THEIR CAUSES.

—EDITED BY—

CHARLES MORRIS

The well-known Historian, Encyclopedist and Scientist. Author of "An Historical Review of Civilization;" "The Greater Republic;" "Decisive Events in American History;" "Man and His Ancestors;" "The Volcano's Deadly Work;" "The San Francisco Calamity;" "Half-Hours with Best American Authors;" Associate Editor on Encyclopedias, etc., etc. *Member of the Pennsylvania Academy of Natural Sciences and the Geographical Society of Philadelphia.*

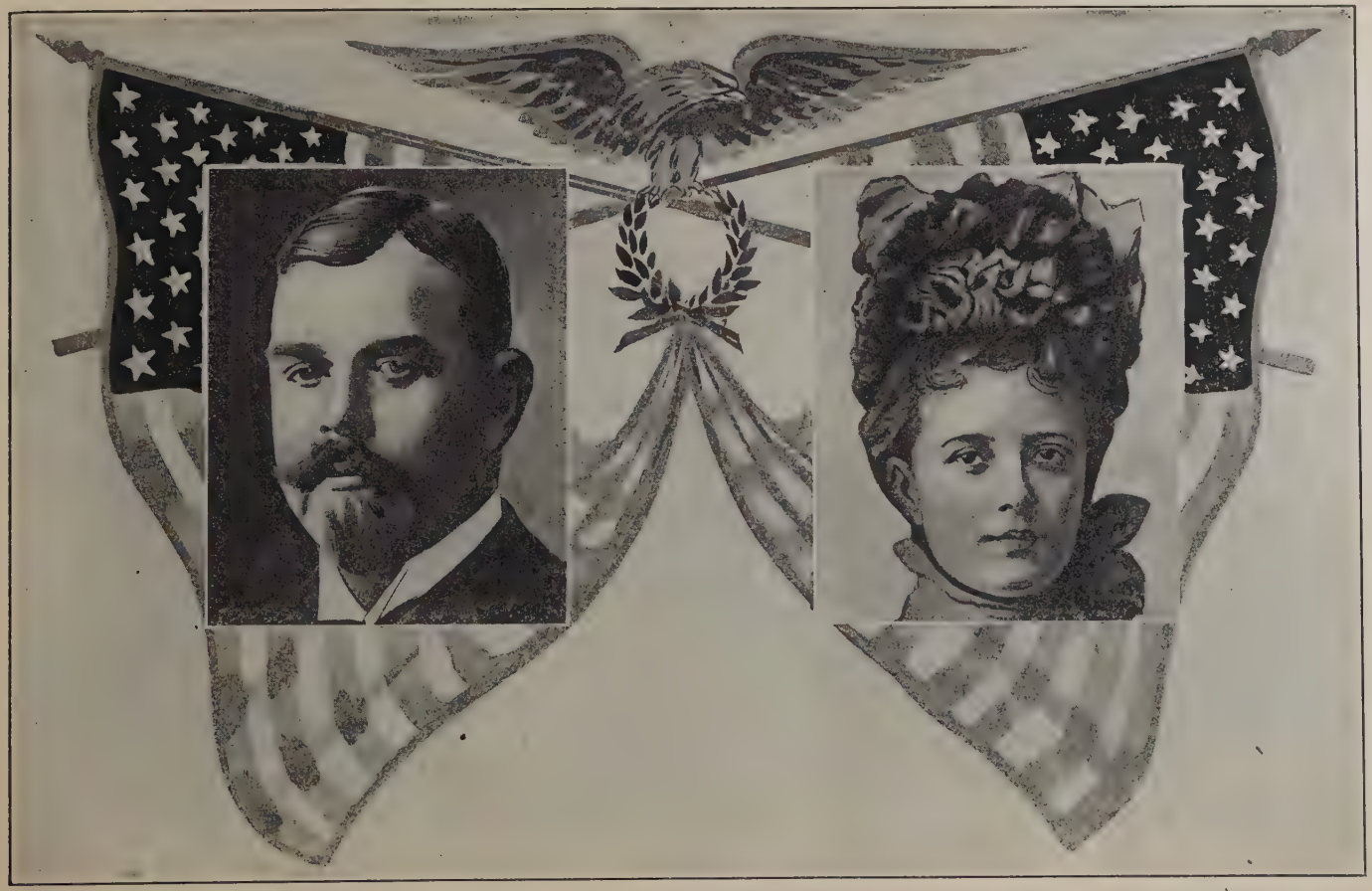
NEARLY 100 ILLUSTRATIONS

MADE ESPECIALLY FOR THIS WORK, SHOWING THE HAVOC CAUSED BY FIRE, EARTHQUAKE AND VOLCANIC CONVULSIONS

36935

Pearlman Memorial Library
Central Bible College

Copyright, 1909, by
E. M. Soull.



MR. AND MRS. ARTHUR S. CHENEY, U. S. CONSUL AND WIFE, KILLED IN THE EARTHQUAKE.

On the morning of December 28, 1908, Mr. and Mrs. Cheney were sleeping quietly at their post of duty, when the earthquake came and slew them before they could rise from their bed. 250 marines from the U. S. Battleship "Illinois" found their bodies in the ruins of the Consulate, on January 16, 1909. Their remains were wrapped in their country's flag and sent home on an American battleship for interment.

Copyright, 1909, by Press Publishing Company.

RUINS OF THE UNITED STATES CONSULATE AT MESSINA.

The American Consul and his wife, Mr. and Mrs Arthur S. Cheney, were killed in the above ruin; and their bodies were not recovered until nearly three weeks after the disaster, when the sailors from the American battleship "Illinois" dug them out of the debris. They were wrapped in American flags, placed in caskets and shipped home for burial. The terrific power of the earthquake may be understood from the above reproduction of an actual photograph. Gigantic buildings were not only thrown down, but were in some places literally torn into splinters.

PREFACE

TACITUS relates how the palaces and noble residences of the beautiful and ancient city of Pompeii were buried in ashes fathoms deep when Vesuvius awoke in its wrath; and sacred history reveals the fate of the doomed Cities of the Plain when a rain of fire and brimstone poured down upon their spires and domes. No record of the past comes to us in more appalling form than these stories of sudden ruin and terrible slaughter by the elemental powers of the underworld. But once again, in our own days, these powers have awakened, and death and destruction have visited ancient and famous Messina, the noble city of the Straits and of Sunny Sicily.

Dreadful is the work that follows the clashing of sinking seas with the lakes of liquid fire pent up in the earth. Rack and ruin attend their meeting, and the dense solid shell of the earth is rent asunder by their might. It is to the battle of fire and water in the depths of the rocks that the volcano and the earthquake are due, and when these demons of the depths are at war man's puny strength is as powerless as that of the leaf before the cyclone. Then terror comes; then the earth trembles to its heart and is rent in twain; then the ashes of a terrible burning are cast forth to bury fertile plains and flourishing cities; then showers of burning rocks bombard the air and rivers of glowing lava scorch the earth, and human hopes and the results of man's labor are whelmed alike beneath the dread torrent of death and dismay.

Earthquake and famine, fire and sudden death—these are the destroyers that men fear when they come singly; how much worse is it when they come together, as they did upon the stricken people of Sicily and Calabria in the recent terrible catastrophe, a hideous quartette whose mission was the death or torment of human beings, the destruction in a moment's time of the wealth they had gathered in years of patient effort. It is the purpose of this book to make a faithful record of the story of that awful hour of ruin when years seemed lived in a minute, and to preserve an accurate chronicle of its events, alike for the people whose hearts throb in sympathy to-day and for the benefit of their posterity.

Other frightful cataclysms the world has known. The earthquake which dropped the greater part of the city of Lisbon into the sea in 1755, and in a moment swallowed up twenty-five thousand of its people; the convulsion which rent Krakatoa Island asunder in 1883, and poured on the coast of Java a tidal wave in which thirty-six thousand human beings perished; the whirlwind of fire which in 1902 overwhelmed St. Pierre in Martinique, with its thirty thousand inhabitants; the earthquake which in 1906 ruined in a moment of time the thronged city of San Francisco, are all significant examples. The earth we live upon is never safe beneath our feet. It may quake and lift into billows at a moment's notice; it may pour forth volumes of fire from the molten lakes which lie in its depths: heedless as we are of all this we are never for a moment safe from some such convulsion of nature.

In view of all this, it has been deemed desirable to make this work a history of disasters of the character named: to gather within its pages a record of all the great convulsions of nature which history records; to recount the theories of the causes of earth-

quake and volcanic action; to describe the geyser, the mud volcano, and all the minor outbreaks of the earth's internal forces. In this way its value will be very greatly added to, as within its pages readers will have a sufficient chronicle of all the famous historic disasters due to these causes.

When the weakness and the folly and the sin of men bring woe upon other men, there are plenty of texts for the preacher and no scarcity of earnest preachers. But here is a vast and awful catastrophe that befell from an act of Nature apparently not more extraordinary than the shrinkage of hot metal in the process of cooling. The consequences are terrifying in this case because they involve the habitations of half a million people; no doubt, the process goes on somewhere within the earth almost continuously, and it no more involves the theory of malignant Nature than that of an angry God.

If we contemplate it, possibly we may be helped to a profitable estimate of our own relative insignificance. We think, with some notion of our importance, of the thousand million men who live upon the earth; but they are a mere handful of animate atoms in comparison with the surface, to say nothing of the solid contents, of the globe itself.

We are fond of boasting in this latter day of man's marvelous success in subduing the forces of Nature; and, while we are in the midst of exultation over our victories, Nature tumbles the rocks about somewhere within the bowels of the earth, and we have to learn the old lesson that our triumphs have not penetrated farther than to the very outermost rim of the realm of Nature.

A few weak, almost helpless, creatures, we millions of men stand upon the deck of a great ship, which goes rolling through

space that is itself incomprehensible, and usually we are so busy with our paltry ambitions, our transgressions, our righteous labors, our prides and hopes and entanglements that we forget where we are and what is our destiny. A direct interposition from a Superior Power, even if it be hurtful to the body, might be required to persuade us to stop and consider and take anew our bearings, so that we may comprehend in some large degree our precise relations to things. The wisest men have been the most ready to recognize the beneficence of the discipline of affliction. If there were no sorrow, we should be likely to find the school of life unprofitable.

For one thing, the school wherein sorrow is a part of the discipline is that in which is developed human sympathy, one of the finest and most ennobling manifestations of the Love which is, in its essence, divine. In human life there is much that is ignoble, and the race has almost contemptible weakness and insignificance in comparison with the physical forces of the universe.

But man is superior to all these forces in his possession of the power of affection; and in almost the lowest and basest of the race this power, if latent and half lost, may be found and evoked by the spectacle of the suffering of a fellow-creature.

The human family looks on with pity while the homeless and hungry and impoverished Sicilians endure pangs. Wherever the news went, by the swift processes of electricity, there men and women, some of them, perhaps, hardly knowing where Messina is, were sorry and willing and eager to help. There are quarrels within the family sometimes, when nation wars with nation, and all love seems to have vanished; but the world is, in truth, akin. "God hath made of one blood all the nations of the earth," and the blood "tells" when suffering comes.

THE PUBLISHERS.

TABLE OF CONTENTS

CHAPTER I.

THE BOOT OF ITALY AND BEAUTIFUL SICILY. THE GARDEN SPOT OF THE MEDITERRANEAN 17

CHAPTER II.

GREEK MYTHOLOGY AND THE VOLCANOES OF SICILY. ETNA AND STROMBOLI, VULCAN'S FIERY WORKSHOPS 31

CHAPTER III.

THE HISTORIC CITIES OF SICILY. THEIR SETTLEMENT BY THE ANCIENT GREEKS AND CARTHAGINIANS, AND THEIR LATER ANNALS 41

CHAPTER IV.

THE STORY OF MESSINA AND REGGIO, THE DOOMED CITIES OF THE STRAITS 56

CHAPTER V.

THE FRIGHTFUL EARTHQUAKE OF 1908 AND ITS SURPASSING HORRORS 68

CHAPTER VI.

THE GIGANTIC TIDAL-WAVE AND ITS SWEEPING DESTRUCTION 79

CHAPTER VII.

THE HARVEST OF THE FIRE-DEMON AND ROBBERS OF THE VICTIMS 84

CHAPTER VIII.
THE PANIC FLIGHT OF A HOMELESS HOST 89

CHAPTER IX.
A WONDERFUL RECORD OF THRILLING ESCAPES 94

CHAPTER X.
ITALY'S KING AND QUEEN HASTEN TO THE SCENE OF DESOLATION 109

CHAPTER XI.
THE BURIED THOUSANDS AND THE NOBLE BAND OF RESCUERS 115

CHAPTER XII.
WORLD-WIDE SYMPATHY AND THE UNIVERSAL BROTHERHOOD OF MAN 120

CHAPTER XIII.
THE RED CROSS SOCIETY, THE LIGHTHOUSE OF INTERNATIONAL CHARITY, SENDS ITS BENEFICENT AID 125

CHAPTER XIV.
THE SUMMING UP AFTER THE GREAT CATASTROPHE 130

BOOK II.

The History and Causes of Earthquakes, Volcanoes and Other Seismic Phenomena.

CHAPTER XV.
FAMOUS EARTHQUAKES OF ANCIENT AND MEDIEVAL TIMES 139

CHAPTER XVI.
THE GREAT LISBON AND CALABRIAN EARTHQUAKES 149

CHAPTER XVII.
EARTHQUAKES IN THE NEW WORLD PRIOR TO 1900 159

CHAPTER XVIII.
THE SAN FRANCISCO CALAMITY AND OTHER EARTHQUAKES OF THE TWENTIETH CENTURY..... 168

CHAPTER XIX.
THE VOLCANO AND THE EARTHQUAKE, EARTH'S DEMONS OF DESTRUCTION 204

CHAPTER XX.
THEORIES OF VOLCANIC AND EARTHQUAKE ACTION 214

CHAPTER XXI.
THE ACTIVE VOLCANOES OF THE EARTH 235

CHAPTER XXII.
THE FAMOUS VESUVIUS AND THE DESTRUCTION OF POMPEII AND HERCULANEUM 247

CHAPTER XXIII.
ERUPTIONS OF VESUVIUS, ETNA AND STROMBOLI 266

CHAPTER XXIV.
VESUVIUS DEVASTATES THE REGION OF NAPLES 288

CHAPTER XXV.
SKAPTER JOKULL AND HECLA, THE GREAT ICELANDIC VOLCANOES 307

CHAPTER XXVI.
VOLCANOES OF THE PHILIPPINES AND OTHER PACIFIC ISLANDS 315

CHAPTER XXVII.
THE WONDERFUL HAWAIIAN CRATERS AND KILAUEA'S LAKE OF FIRE 334

CHAPTER XXVIII.
POPOCATEPETL AND OTHER VOLCANOES OF MEXICO AND CENTRAL AMERICA 351

CHAPTER XXIX.
THE TERRIBLE ERUPTION OF KRAKATOA 359

CHAPTER XXX.
ST. VINCENT ISLAND AND MONT SOUFRIERE IN 1812 377

CHAPTER XXXI.
MONT PELEE AND ITS HARVEST OF DEATH IN 1902 388

CHAPTER XXXII.
SUBMARINE VOLCANOES AND THEIR WORK OF ISLAND-BUILDING 423

CHAPTER XXXIII.
MUD VOLCANOES, GEYSERS AND HOT SPRINGS 433

BOOK I.

An Account of

The Great Earthquake of 1908

The Destruction of the Cities of Reggio and Messina and Scores of Towns; and the Laying Waste of Vast Sections of Country in Italy and Sicily

A CALAMITY COLOSSAL WITHOUT A PRECEDENT

THE SCENE OF NATURE'S MOST AWFUL DISASTER
(December 28, 1908)

CHAPTER I.

The Boot of Italy and Beautiful Sicily. The Garden Spot of the Mediterranean: Its Tradition, History, Geography, and Scenic Attraction.

MIDWAY in the greatest of inland seas, the famous Mediterranean, lies the splendid island of Sicily, the greatest in geographical and historical position in that great body of water. At one time, as science and tradition tell us, it formed a connecting link between Europe and Africa, a great natural roadway between the two continents, dividing the Mediterranean into two vast lakes or inland seas, one of the east and one of the west.

Geological research makes it evident that Sicily at one time extended southwestward and joined the coast of Africa, and legend advises us that its northeast coast closed the present Strait of Messina, making the island an extension of the long peninsula of Italy. It was touched, in fact, by the toe of that singular boot-like projection which gives the south of Italy the appearance of taking a step forward into the sea, a step which would bring it in touch with the rock-ribbed coast of Sicily. The Strait, indeed, is only two miles wide in its narrowest section, and a giant foot might almost step from mainland to island in a single stride.

Triangular in shape, Sicily has an area of 9,860 square miles, identical with that of our state of Maryland. Its surface is elevated, most of it standing more than 500 feet above sea level, while in many

places it is mountainous. Its loftiest elevation is that of the great volcano of Mount Etna, which rises with an exceedingly gentle slope from a base of 400 square miles in area to a height of 10,860 feet above sea level. In dark and never ending threat this huge smoking and flaming mass towers above the east coast of the island, at times pouring rivers of glowing lava down its rugged sides while the earth quakes in responsive sympathy, levelling like ant-hills the proudest erections of man upon its surface. Greatest and most phenomenal of all these disasters was that of the 28th of December, 1908, whose death-roll was one of the highest ever known in the earth's record of similar convulsions of nature. A full account of this frightful cataclysm is reserved for a later chapter of our work, it seeming a more satisfactory and artistic presentation of our subject to lay before the reader the scenic surroundings before dealing with the great event which gives them such striking importance.

THE ISLAND OF SICILY.

The island of Sicily of old was given the poetical name of Trinacria, arising from its triangular shape, and referring to its three promontories of Pelorum (now Faro) in the northeast, Pachynum (now Passaro) in the southeast and Lilybæum (now Boeo) in the west. It occupies a part of the Mediterranean so shallow as to indicate that it was once above water, dividing the sea into two basins. The water between Sicily and Cape Bon in Tunis, is now, except for a very short interval, less than 100 fathoms in depth. The very narrow Straits of Messina, which separate it from Italy, are much deeper, nearly everywhere exceeding 150 fathoms.

There are indications in the character of the rocks around this strait that the island once formed part of the mainland, but was split

off from it at an ancient date. Afterward it seems to have been joined again for a period, and Africa may also have been joined to Sicily in a recent geological period, as is shown by the fossil bones in Sicily of the African elephant, hippopotamus and hyena. But all this was probably before man came upon the earth and inhabited that island.

The north coast of Sicily is generally steep and has many good harbors, of which that of Palermo is the best. In the east also steep, rocky coasts prevail, except opposite the Plain of Catania, and in the northern half of this coast the giant mass of Mount Etna erects itself as a vast landmark, while its lava streams stand out for a distance of about twenty miles in a line of bold cliffs and promontories. In the west and south the coast is generally flat and less favorable to shipping.

The tides here, as in the rest of the Mediterranean, are so slight as to be scarcely observable, yet at several points in the west and south coasts the water occasionally rises suddenly to the height of three feet, and this is repeated at intervals of a minute sometimes for a number of hours. The cause of this curious oscillation of the water is not known.

The mountains of Sicily are chiefly in the north, their lower slopes everywhere being cultivated and forming a continuous series of olive groves and orange fields. The rest of the island is a plateau of varied elevation and to a great extent is devoted to the growth of wheat. The only large plain in the island is that of Catania, immediately south of the foothills of Etna. It is watered by the Simeto river.

THE SICILIAN CLIMATE.

Coming now to the question of climate, we find that Sicily has the warm and equable temperature of most of the Mediterranean

region. The mean temperature of January is nearly as high as the October temperature of southern England. Snow is rarely seen on the coast, though on the higher peaks it lies till June and on Etna till July. The rainfall is so low in the summer months that most of the streams dry up in that season. In the winter it is often so great as to make torrents of the streams.

While the summer climate is usually soft and salubrious, it is not always so, the island being subject to a severe scourge in the *Sirocco,* a hot, dry, strong and parching wind which comes from the south, bringing with it leaden-colored and hazy skies, due to immense quantities of reddish dust brought from the Sahara desert. It lasts at times for three days, and while most frequent in April, no month is quite free from it. The same name is given to a moist and not very hot, but oppressive wind, which blows at times from the southeast. The Sirocco is the one thing that renders Sicily an unpleasant place of residence. Fortunately for the foreign residents it rarely occurs in the winter, the season in which the island is most attractive to these comfort-seeking birds of passage.

SICILIAN AGRICULTURE.

The flora of Sicily is remarkable for its wealth of species. It being more densely populated than any other large island of the Mediterranean and its people depending largely upon the products of their soil, it is extensively cultivated, and many plants may be seen in its fields which are not natives of the island. The olive, which is widely grown for its oil, must have been introduced ages ago, but the orange and lemon, the agave and the prickly pear, and various other plants characteristic of the island scenery, have been added during the Christian era.

There are three zones of vegetable life on the island; that of the orange family, which reaches to about 1,600 feet above sea-level; that of wheat and the vine, which ascends to about 3,300 feet; and that of forest land, which extends above this level. The mountains of Sicily are admirably adapted to foster a flourishing growth of cultivated trees in a climate of little rain during the warmer months. Composed mostly of limestone, they act like so many great sponges, the water sinking into and percolating through their innumerable pores and fissures. Thus stored up in their interior, it wells forth in springs at lower elevations, favoring the irrigation which is absolutely necessary for the orange and lemon during the dry season. Thus it is that all the higher lands in the north and northeast of the island present an endless succession of orchards of the orange, citron and lemon, together with groves of olives, almonds, pomegranates, figs, carobs, pistachios, mulberries and grapes.

As an export crop the orange and lemon are especially important, and the Messina orange has a world-wide reputation. Since the steamship era the commerce in these fruits has greatly increased, and a striking feature in the commerce of the island is in the great supply of its fruits which is sent to the United States. Even more extensive than the cultivation of the orange and lemon is that of the olive, but this is less for exportation than for home consumption. This plant is grown to an elevation of about 2,700 feet, while that of the vine extends to some 800 feet higher. Among the plants adapted to a dry climate are the date palm, the plantain, the bamboo, and the dwarf palm, the latter growing in the greatest profusion in parts of Sicily. In the desolate region of the southwest it is nearly the only important vegetable product. Other plants which thrive on the driest soil are the deep-rooted sumach, the agave, and the prickly

pear, the latter being a favorite article of diet. In the spring season beans form the chief article of food.

If we now leave the region of the oak and fruit trees, which form the chief element of the highland forests, and that of cultivated trees, and descend to the open country, we find the soil very largely devoted to the growth of wheat. At present—as was the case in the days of the Greek colonies and the later ones of Roman supremacy—Sicily is a rich granary, capable of feeding a large population. Fully three-fourths of its cultivated surface are devoted to cereals, especially to wheat, and it is this plant which gives character to the Sicilian landscape through most of the year. In the plain of Catania cotton is grown along with wheat, and the sugar cane and tobacco are cultivated to some extent.

A singular fact in regard to the population of the island is that the far reaching slopes of Mount Etna are far more densely peopled than any other agricultural region of Sicily or of Italy. While the mean population of the rest of Sicily is 88, and that of Italy 90, to the square kilometre, that of Mount Etna numbers 450, forming an abiding place of 300,000 of the Sicilian people, dwelling in two cities and sixty-three villages. If we be asked the reason for this, the answer will be that it is due to the great fertility given the soil by the disintegrated lava. Here is an attraction to an agricultural community that sets aside the threat of the fire-vomiting mountain, and induces the peasantry to dare the peril of an occasional outpour of destroying lava for the benefits which the lava-coated mass yields them.

The island is in a very large degree an agricultural one, its one other important industry being the mining of sulphur, the most valuable mineral product of the island. There are about 300 mines

in operation, nearly all the sulphur being exported. Rock salt is another mineral of some value, about 3,000 tons being excavated yearly.

THE CHARACTER OF THE PEOPLE.

Let us now say something of the people of the island and their mode of life. In view of the fact that Sicily has been held at times by the Greeks, the Carthaginians, the Romans, the Saracens, the Normans, the Spaniards, and other peoples, its population is necessarily somewhat conglomerate. The Greek element prevails in the east and the Arab in the west, while the dialect of the Lombards survives in parts of the interior. Despite his poverty and his hard labor, the wretched character of his home and his unpalatable food —which consists of black bread, onions, beans, herbs, prickly pears, bitter cheese and weak wine, with rarely a taste of meat—the Sicilian is good humored and obliging, manly and independent. The laborers, whose wages range from 1s. to 2s. a day, live in dirty, one-roomed houses, which they share with their pigs and poultry, with dilapidated tile roofs through which the smoke goes out and the rain comes in; the bed, when possible, being sheltered with a strip of matting. The craftsmen have as dirty houses, though these have tiled floors and better furniture. As for the well-to-do inhabitants of the island, they live in the cities, there being no country gentlemen in Sicily, nor any houses for them. Even market-towns are unknown, though at times fairs are held.

We have given the better side of the Sicilian peasantry; now their worse side must be mentioned. The peasant is cunning and deceitful, is very cruel to animals, and seems natively vindictive and treacherous. Robberies and thefts are frequent, and for homicides

Sicily is one of the worst countries in Europe. Brigandage on a large scale, formerly common, has been put down, though bands of highwaymen still at times appear. The secret and law-defying society of the Maffia continues to exist, though much reduced in numbers and importance, and the vendetta is apt to take the place of legal methods of punishment. This state of affairs is fostered by the ignorance of the people, three-fourths of whom can neither read nor write. Devout they are, in their way, but their religion consists largely of superstition.

CALABRIA AND ITS PEOPLE.

Crossing now the Straits of Messina to the near by Italian province of Calabria, the foot of the Italian boot, a district which, near the Strait, severely felt the desolating effect of the earthquake, we find ourselves among a people not unlike the Sicilians. Proud, fiery and revengeful, they were long known as among the fiercest of banditti, and were so warlike and courageous that they resisted the armies of Napoleon until after all the rest of Italy had been subdued, not being finally quelled until 1810.

Calabria has an area of 6,600 square miles, it being somewhat larger than Sicily. Long and narrow, theAppenines form its backbone throughout, traversing its 160 miles of length; forests of oak, beech, and chestnut clothing their sides, while pine crowns their higher peaks. Calabria possesses only small streams, but these give fertility to the valleys between the hills, which afford rich pasture to the flocks and herds, and to the plains, the soil of which is very rich.

Here grow wheat, rice, cotton, saffron, liquorice, sugar-cane, and other useful plants, also such fruits as the orange, lemon, olive,

fig, and mulberry, while the tunny and anchovy fisheries of the coast are of importance. The province is also well supplied with minerals, including iron, tin, silver, lead, alabaster, marble, and graphite.

The warmth of the climate and the extreme fertility of the soil are not conducive to progress among the people, and agriculture is in a very rude and barbarous condition, the people, as may be supposed from this, being ignorant and unenterprising.

SUNNY SICILY.

Passing from its material to its picturesque aspects, the Sicilian isle is one of manifold attractions. It may well be called Sunny Sicily, the sun shining for some three hundred days in the year, and throwing a brilliance over land and water alike that makes this isle a paradise for the artist and the lover of rich color and glowing landscape effects.

The life of the Sicilian is one of endless warmth, brilliant sunshine, blue skies, lovely flowers, gleaming waters. The sea everywhere envelopes the island and shines like a mirror through most of the year. All who visit that little isle at the toe of Italy find themselves fettered by its charms. Goethe wrote of it long ago: "Italy without Sicily leaves no image in the soul; here is the key of all." And many to-day yield to the glamour which took the great poet captive. Though so near Europe the vegetation of Sicily resembles that of warmer climes, semi-tropic plants and fruits abounding, while the soil yields two crops a year.

Everywhere in the northeast the giant bulk of Etna dominates the scene. From Reggio, on the opposite coast of Calabria, the snow-clad peak may be seen lifting its majestic head high above the fruit trees on its slope and the blue waters at its feet. A traveller thus

gives the normal impression from this point: "The first view of the volcano was enchanting. The day was glorious, and the bright sunlight, the glistening snow, the clear blue-green water were all like a dream." It is the same everywhere. The traveller quoted thus speaks of Palermo, over the charm of whose bay many writers have raved:

"The bay is a fine sweep, and Mount Pelligrino is a handsome finish, but the bay is hardly as beautiful as Naples and the rock is not so imposing as Gibraltar or Quebec. But the wonderful color-charm prevalent in Sicily is manifest in Palermo; a certain quality of atmosphere gives clearness and haze by turns, and each in turn gains something more beautiful in tone than its predecessor. It is verily an artist's paradise, a paint-box riddle. Then, of course, one of its chief charms is the street life. Here again the artistic eye revels—the side-alleys are a kaleidoscope of queer scenes."*

Everywhere and at all seasons scenic effects of this kind may be looked for. In January, when snow and ice reign at the North, here the flowers open, the perfume of blossoms is in the air, the island is full of color and sweet smells. We might go on, lapsing into ecstasies over the scenic beauty of this lovely Mediterranean isle, but one more quotation from a sight-seer must suffice:

"There before us stood Sciacca straggling up the hill-side, grey and white in the sunshine, with pretty-colored tiled domes. Below was that turquoise-blue opalescent sea so often observed around Sicily, and behind, on a steep, hilly summit, stood the monastery of Monte San Cologero, rising 1,300 feet from the sea below. It really was a wonderful panorama. The day was lovely, lights sparkled on the white houses, while the dark cypress and grey olives,

* "Sunny Sicily," by Mrs. Alice Tweedie.

Copyright, 1909, by Press Publishing Company, New York World.

ITALIAN PEASANTS HUNTING FOR DEAD OR LIVING.

Extraordinary cases of human vitality were revealed by the rescuers among the ruins. A woman and two infants had been buried alive for eleven days and she had nursed the little things all that time, but after they were found and carried to safety, one of the babies died. This picture was taken at Bagnara, Italy, just after the earthquake of December, 1908.

Copyright, 1909, by the Pictorial News Co.

SEARCHING THE RUINS FOR DEAD LOVED ONES.

Anxious relatives are seen in this picture searching for their missing friends or members of their families. This photograph was taken at Bagnara, on the west coast of Italy, a little north of Reggio, and portrays with terrible detail how complete was the destruction of the ill-fated cities in the path of the earthquake. The houses were crumbled to small fragments, in many cases burying their inmates under a crushing weight of wood and stucco mortar.

the white almond blossom and blue-grey olive, made a perfect landscape, with goat-herds wandering along the roadside to add picturesquesness to the scene."

ANIMAL LIFE IN SICILY.

Speaking of the goat-herds, we are led to say something about the animal life of Sicily, and especially about the goat, that ubiquitous tenant of hill and plain. The goat is to be seen everywhere. No country can surpass Sicily, few equal it, in numbers of these animals. We may see them by the thousands. Wherever we go they intrude their forms as part of the landscape. They forage for themselves, it costing next to nothing to keep them. Anything of food character—bits of lemon or orange peal, strips of sea-weed, straggling blades of grass—serve their turn. They are very fond of the prickly pear,—when it is cut up for them,—it is too hard and spiny for them to attack it when growing.

Whole herds of goats are owned by some, often a single one by others. This is sent off in charge of a child every morning to browse by the roadside and brought home at evening to be milked, and often to sleep with the family. Butter, milk and cheese from this animal are to be had anywhere, and even in the large cities the goats are driven through the streets and their milk sold to any one who comes with a vessel to receive it.

Cows are also driven through the streets for the same purpose, their owner calling out that milk is for sale—though this is considered inferior to that of the goat. The cow heralds her approach by a bell around her neck. These animals wear wooden collars, six to eight inches wide, on which are painted quaint religious pictures. Sheep are also raised in numbers, and may be seen daily following the shepherds along the roads.

SICILY IN ITS HISTORIC ASPECT.

Sicily has long lain in the path of the conqueror and has for ages been the prize of the most enterprising. The north coast looks toward Italy and was overrun by the Romans; the southeast coast faces Greece and became the prey of Greek wanderers; the southwest invited the Moors and Saracens from Tunis, and they occupied Sicily for two centuries.

Going back to the remote times we are told of the fabulous Cyclopes as the first inhabitants of the island. The earliest known people there were the Sikans, and in the north were Sikels, a people from Italy. Coming to distinctly historic times we find the sea-going Phœnicians in the island, founding cities represented by the modern Palermo and Solanto. But for the real settlers and civilizers of Sicily we must look to the Greeks, the founders of many cities, such as Messina, Syracuse, Catania, Agrigentum, and various others. These cities, long independent, in time fell under the rule of ambitious individuals, of whom Gelon in 485 B. C. transferred the seat of government from Gela to Syracuse, which for many centuries afterward was the chief city of the island.

Soon from Carthage, the great African seat of commerce, came settlers of a new race, battling with the Greeks. Of early important events were the battle of Himera, in which Gelon won a great victory over Hamilcar of Carthage, and the fatal expedition of an Athenian fleet to Syracuse in 415 B. C., which led to the fall of Athens as the great power in Greece.

The next events of interest were the invasion of Sicily by the first Hannibal, who destroyed various cities and founded Lilybæum; and the reign of Dionysius the Tyrant (405-367 B. C.), who fought Carthage in four wars, defeated her armies, and invaded Italy.

Copyright, 1909, by the Pictorial News Company.

SOLDIERS CARRYING BODIES FROM THE RUINS.

This photograph, from the scene of the earthquake in Italy in December, 1908, shows how the soldiers removed those who might, by chance, still be living, to one of the temporary hospitals which were established as soon as supplies were rushed to the stricken districts. The view shows one of the comparatively little injured streets, yet the walls of a demolished house are seen in the background.

Copyright, 1909, by Press Publishing Company, New York World.

HEADS OF VICTIMS PROTRUDING FROM DEBRIS.

While the bodies of thousands were yet buried in the ruins of their homes this gruesome photograph was made, showing in one heap of debris the heads of no less than four victims sticking out of the mass of wreckage. White circles have been drawn around the spots in the photographic plate to mark more clearly the position of the bodies.

This struggle between the Greeks and the Carthaginians continued until Rome came into the field as the great enemy of Carthage, the wars of these two great cities beginning on the soil of Sicily. The Roman invasion ended in 210 B. C., the whole island then becoming a province of Rome, and remaining so for centuries afterward.

When the Roman Empire fell, the Vandals, under Genseric, were the first of the barbarian hordes to invade and occupy the island (440 A. D.). In 535 it was taken by Belisarius, an able general of the Eastern Empire, and remained under the sole rule of Constantinople until 827 A. D., when the Saracens of northern Africa made their first invasion. For more than a century their work of conquest continued. Syracuse was taken by them in 877, and the last stronghold, Rametta, in 965, and for nearly a hundred years later no one questioned their dominion.

In 1038 the emperor at Constantinople sent George Maniakes, with an army in which were many Normans, to attempt the reconquest of Sicily. Various towns were taken, the Normans came to the front in the conflict, and at length the whole island fell into their hands, Robert Guiscard and his brother Roger ruling in 1090. A second Roger, son of the first, was crowned in 1130 as the first king of Sicily, and proved himself a great monarch. Christianity was introduced by him, and for many years he ruled wisely and well.

The crown fell to the German emperor, Henry VI, in 1194, and in 1197 to his son Frederick II., who ruled the whole empire from his throne in Sicily. In 1264, Charles, Count of Anjou, was made king, and Sicily fell under French control. It was handled in a manner that exasperated the Sicilians, and in 1282 they revolted in the bloody "Sicilian Vespers," in which they massacred every French man, woman and child in Palermo.

Other changes took place in Sicilian rule, Spain eventually gaining control, and holding it for centuries. The last important political event was when Garibaldi invaded the island in 1860, took Palermo, and opened the way for Sicily to be added to the new kingdom of Italy. There it is likely long to remain.

Nothing has been said above of the convulsions of nature to which Sicily is subject, the occasional destructive explosions of Mount Etna, and the more frequent ruinous earthquakes, of which the island has had many terrible visitations. Chief among these may be named the one which destroyed Catania in 1170, burying 15,000 of its inhabitants in the ruins, and that of 1693, which ruined fifty-four towns and 300 villages, with the loss of more than 100,000 lives. To these must now be added the frightful one of 1908, the ravages of which are fully described in the following chapters. It is well to say here that the latter had a political significance in the self-sacrificing devotion of the monarch of Italy to the sufferers of Messina, which aided greatly in cementing the union between Italy and Sicily, making it a union of hearts as well as of states, of sympathetic feeling as well as of political expediency.

CHAPTER II.

Greek Mythology and the Volcanoes of Sicily Etna and Stromboli, Vulcan's Fiery Workshops.

MYTHOLOGY has its place in the beautiful Sicilian isle as in all the lands settled by men of the Grecian race. This island early attracted the attention of the sea-wandering Greeks, and they transferred to it many of the adventures of their deities, especially the giant early ones, those of vast and brutal power. We cannot deal with the island without some reference to this feature of its traditional lore, and we do this in confidence that readers will find something to attract them in the monstrous doings of the mighty early gods.

The leading gods of Sicily are the gods of force, the deific representatives of the tumultuous elemental powers. It was to the vast power of Etna that the poets directed their attention, and in their fancy this vast, flaming pile, with its earthquaking accompaniments, was a fitting prison-house for the giant Typhon or Enceladus, the monstrous son of the Earth and Tartarus, of the terrestrial and the demonic powers. A gristly monster was this huge creature of the elements. A hundred dragons' heads whirled in snaky threat from his vast frame, and he dared rebel against heaven itself. In the mighty war that followed Zeus, the king of the gods, overcame this monster rebel and imprisoned him under the mighty bulk of Etna. Here he has ever since lain, if we may credit the

fables of the poets, groaning in his helpless fury until his roaring voice pours in thunder from the crater's mouth. When he breathes his fiery breath forms the flames of the volcanic terror. And more terrible is he when he turns on his rocky couch, for then the whole earth above him is lifted and desolating earthquakes rock the island.

Pindar, the famed Greek poet, speaks of him in his first Pythian Ode, written when King Hiero of Sicily won in the chariot race of 474 B. C. Thus he sings of Typhon: "He is fast bound by a pillar of the sky, even by snowy Etna, nursing the whole year's length her dazzling snow. Whereout pure springs of unapproachable fire are vomited from the inmost depths; in the daytime the lava streams pour forth a lurid rush of smoke, but in the darkness a red, rolling flame sweepeth rocks with uproar to the wide, deep sea."

Etna is also famed as the home of another god, one of less monstrous attributes, the Greek Hephæstus, known to us more familiarly by his Roman name of Vulcan. This deity, one of the court of the gods on Mount Olympus, was the "Tubal-cain" of heathen mythology, the fire-god, the blacksmith of the deities. The son of Zeus, he was flung from heaven by his great father in a moment of rage and was lamed by his fall. This story of the fall of fire doubtless represents the lightning flash in its descent from the clouds to the earth. From this time we find Vulcan as a terrestrial deity, the mighty blacksmith of the gods, setting up his great forge in the profound depths of Etna, where the sound of his hammer is still to be heard, as he forges the weapons of the gods.

While Etna is thus in mythology the prison of a chained giant and the workshop of a swart and sooty god, there are other deific beings who inhabit its depths. These are the Cyclopes, who worked as slaves of Vulcan at his forge in the heart of the burning moun-

tains, not only Etna, but also Stromboli and Lemnos, forging out thunderbolts for Zeus or Jupiter. Sons of Uranus, and belonging to the race of the Titans, their father, in dread of their enormous strength, confined them in the centre of the earth, but in the wars between the gods and the Titans, Zeus set them free and furnished them with thunderbolts to aid him in the mighty struggle. Their names, Brontes, Steropes, and Arges, indicate the noise and flash of a volcanic eruption.

Homer gives us another legend of the Cyclopes, also connected with Sicily. In the "Odyssey" we find them as a wild and impish race of giants, dwelling on the sea coast of that island; while Hesiod tells us that they were one-eyed, having a single eye in the middle of the forehead. It was with Polyphemus, the most celebrated of this giant race, that Ulysses had his famous adventure. When he landed in Sicily, he found this huge giant dwelling in a cave, which he entered with twelve of his companions. Polyphemus seized six of these wanderers and consumed them at a single meal. Fearing for himself and the other six the shrewd Greek placated the giant, induced him to drink wine until he fell into a drunken slumber, then bored out his one eye with a burning pole and, escaping with the aid of a cunning device from his cave, he took to his ships, which barely escaped from the huge rocks which the blind and raging giant flung after the Greeks in their flight.

There is a natural origin for this mythological story. It is supposed that the Cyclopes may represent the many small craters on the slopes of Etna, their single eye being the single fiery vent of the crater, while the stones which Polyphemus hurled after the fleeing Greeks were probably those vomited forth by the volcano itself.

The famous voyage of Ulysses—the Odysseus of Greek legend

—as set forth in Homer's noble epic poem, the "Odyssey," has much to do with Sicily, and its stories of that island are of so much mythological interest that we feel impelled to add to the tale of the Cyclopes that of the sea monsters Scylla and Charybdis, especially as these had their abiding place in the immediate vicinity of the recently wrecked Messina.

These sea perils remain to-day, but shorn of their early terrors. To our sober geographers they are two "races" or rapids in the Straits of Messina, arising from the flow of opposing currents through the narrow channel, Scylla being the one near the Italian, Charybdis that near the Sicilian coast. The dangers of these "races" have been greatly exaggerated. In old times, when small, open vessels preceded the ships of modern times, they were so greatly feared by seamen as to be converted by the poets into two frightful monsters, and to give rise to the proverbial "To shun Charybdis and fall into Scylla." With this needful preliminary, we will proceed with Homer's story of the adventures of Ulysses.

In the poetic version, Scylla and Charybdis were two sea-monsters of frightful mien, dwelling on the opposite sides of the narrow strait, and taking deadly toll from every seaman's craft that passed. Scylla was a horrid creature, with twelve feet and six long necks and mouths, capable of reaching far out and down from the rock-cave in which she dwelt. In each mouth were three rows of sharp teeth, and while awaiting her prey she barked like a dog. Charybdis dwelt on the other side, under a cliff on which grew a single, protruding fig tree. Thrice each day she sucked the waters of the sea down into her capacious maw and thrice threw them up again—this being the poets' picture of a whirlpool.

The rock of Scylla was fabled to be a sharp peak, so high that

its head was lost in the clouds, its surface so smooth and polished that no one could climb it, even if possessed of twenty feet. In its mid-height, beyond the utmost arrow flight, lay the cave of Scylla, from which she barked with hideous voice and stretched out her heads in search of prey. So fierce and bold were these savages of the deep that Neptune himself could not save mariners from their assaults. When Ulysses found it necessary to pass the straits, Circe, the magic sorceress, advised him to hug the shore on Scylla's side and dare her fury rather than to have ship and crew sucked into the yawning jaws of the opposite monster.

Ulysses twice passed through the perils of the strait, once with his vessel and crew, the second time floating back on the wrecked timbers of his craft. On the first passage Scylla reached down her long necks and seized six of the seamen, one in each dreadful mouth. On his return, a lone passenger on the floating hull of his vessel, he was carried past Charybdis, who sucked in the waters and their floating freight, Ulysses saving himself by seizing a bough of the fig tree that grew above. Here he hung with his feet dangling in the air until the monster vomited forth again the drunk-in sea, with its floating raft. On this Ulysses let himself fall and was borne in safety away.

This was not the only adventure of the wanderers in this region. After passing Scylla they landed on the island Thrinacia (Sicily), on which feed the sacred oxen of the sun. Some of these cattle were killed and eaten by the famished Greeks. For this act of sacrilege they were doomed never to see Greece again, their vessel was wrecked, and Ulysses escaped alone by daring the perils of Charybdis as above narrated.

Here, too, or in this vicinity, the Greek hero had his famous

adventure with the Sirens. These mythical beings sang so sweetly as to enchant all who heard them. They dwelt on an island near the Italian coast, which may well have been one of those in the Sicilian seas, and sat in a meadow near the shore, alluring with their voices all who sailed past. He who listened to their song forgot his home and all he held dear and remained with these enchanters until he perished or became brutalized.

Ulysses, with his usual shrewdness, managed to hear their sweet song and escape its fatal effect. Making his sailors plug up their ears so that they could hear nothing, and forbidding them to pay any heed to his gestures or demands, he bade them to tie him to the mast of the ship. While passing the isle, the song of the Sirens allured him as it had done many victims before, but his frantic gestures to be freed had no effect upon the crew, and he escaped the wiles of the singing enchantresses.

For another adventure of Ulysses we must seek the Lipari or Aeolian Islands, north of Sicily in its Messinian quarter. Here are the ever-burning Stromboli and the burned-out Vulcano. Of old there was more than this, if we may credit Homer, for here dwelt Aeolus, the god or ruler of the winds. Some of the old writers place his home in Stromboli, others in Lipari, while still others find him a place of residence in Rhegium, Italy—now the earthquake ruined Reggio.

This deity, the son of one of the gods, had all the winds in his care, confining them in a vast cavern. In the "Odyssey" he is spoken of as the king of the Aeolian Islands, to whom Jupiter had given the care of the winds, to let them out or confine them at his will. Friendly to Ulysses, he gave the wandering hero all the adverse winds tied up in a bag, leaving loose only the favoring

breezes. Of course, as happens in all such cases, meddlers opened the bag and the storm winds got abroad.

For a vivid description of the country of the winds, and of their prison, constructed of high mountains, whence they could issue only on the permission of Aeolus, we may quote the following passage from Virgil's Aeneid," as translated by Corrington.

"Here Aeolus, in cavern vast,
With bolt and barrier fetters fast
Rebellious storm and howling blast.
They with the rocks' reverberant roar
Chafe blustering round their prison door;
He, throned on high, the sceptre sways,
Controls their moods, their wrath allays.
Break but that sceptre, sea and land,
And heaven's etherial deep,
Before them they would whirl like sand,
And through the void air sweep."

It may seem to our readers that Ulysses had most of his adventures in or about Sicily. He certainly did find that island and its vicinity strangely inhabited. Since his day the one-eyed Cyclopes, the man-eating monsters of the Strait, Aeolus the wind god, the alluring Sirens, and all that mythical crew, have vanished, and with them the Lotophagi or lotus-eaters. These, it is true, probably made their home on the coast of Africa, though Homer's account might apply to Sicily. Ulysses visited them with his companions, who found the sweetness of the lotus fruit as enchanting as the song of the Sirens, those who ate of it losing all desire to return home and even forgetting that they had any other home. This feeling of

happy and listless content has been beautifully delineated in Tennyson's poem, "The Lotus Eaters." As usual, Ulysses escaped the charm.

There are other myths connected with Sicily, besides those given by Homer, an interesting one being that of the loves of Acis and Galatea. Acis was a son of Faunus, the Roman god of fields and shepherds. A handsome youth, he loved the nymph Galatea, who returned his love, and in so doing awakened the jealousy of another lover, the huge Polyphemus. Furious with rage at his rival, the one-eyed Cyclop crushed the lover with a huge rock. From under this flowed his blood, which was changed by the nymph into the river which bore his name; now known as Fiume di Jaci.

We now come to the most interesting and famous of the myths connected with Sicily, that of the goddess Ceres and her daughter Proserpine—the Demeter or Persephone of the Greeks. The Greeks placed the scene of this myth in the Nysian plain, in Asia, but the Latin poets made Enna, in Sicily, the scene of the abduction of the maiden goddess. This beautiful maiden was the daughter of Jupiter and Ceres, the latter the earth goddess, the patroness of agriculture and fruits.

The myth runs as follows: While Proserpine, with her girl companions, was gathering flowers in the meadows of Enna, she was attracted by a splendid flower, which bloomed magically before her. Stooping to pluck it, the earth opened and, drawn by immortal steeds, Pluto, the dark god of the nether world, rose from the yawning chasm. Seizing the terrified girl, who called in vain on her father for aid, he bore her in his golden chariot to the gloomy realm over which he reigned.

In distraction at the loss of her daughter, Ceres sought her with

blazing torches in all parts of the world and in her passionate search for her daughter lighted the fires of Etna. Fnally Helios, the god of the sun, told the tale of the abduction to the distracted mother, and Ceres, burning with anger, left the abode of the gods upon Olympus and descended to dwell among men. She also withdrew her bounty from the soil and the crops withered, the fruits shrunk, and men were threatened with famine. To bring back fruitfulness to the earth Jupiter sent his messenger to Pluto's realm with orders to the latter to restore the abducted daughter of Ceres.

Before letting her go, Pluto induced her to eat part of a pomegranate with him, and this held a charm that compelled her to spend a third of the year in her husband's gloomy realm, returning to her mother for the remainder of the year. Later writers say that she spent half of her time in Hades, the other half on earth. There can be little doubt that this beautiful myth is a representation of the revival of the earth in spring after the gloom of the winter. Its appropriateness to our purpose lies in the fact that Enna in Sicily is the scene of the story, as told by the Roman poets, and that Ceres wandered over the Sicilian hills with her torch in the search for her lost daughter.

To the early Greek mariners, Sicily lay in the remote regions of the west, and became to them a region of such wonders as those we have detailed. It was long to the Greeks what the Spanish Main was to the rovers and buccaneers of a later date—a land for piratical incursion. The Sicels were slaveholders, and if we return to the "Odyssey," we find the suitors of Penelope, the wife of Ulysses, advising her son Telemachus to seize his undesirable guests and sell them as slaves to the Sicels, who would pay a good price for them. Among these guests was his own father in disguise. All readers of

the "Odyssey" will know the prompt and effective way in which Ulysses retaliated on the suitors, who had taken advantage of his long absence to annoy his wife with their claims for her hand. As the story goes, the faithful Penelope evaded their importunate demands by promising to accept one of them when she had finished a shroud for the aged Laertes, the father of Ulysses. By ravelling out at night what she had woven by day, she managed to postpone her answer until the return of the wanderer.

It will appear from the above narration that Sicily was as much a home for the creations of mythology as Greece itself, and especially for its darker and more terrible forms. These the imagination of the poets wove into a network of horrors which seem strangely out of consonance with the Sicily of to-day, but which doubtless had their origin in the terrific outbursts of its fiery mountain, its earthquaking tremors, and the difficulty and danger of navigating the Straits of Messina by the small craft of that early age.

Copyright, 1909, by Press Publishing Co., New York World.

MESSINA'S SHATTERED TENEMENTS.

This is one of the poorer tenement houses after the earthquake and tidal wave. The walls were stripped from this row of houses.

Copyright, 1909, by Press Publishing Co., New York World.

BRITISH SAILORS IN RESCUE WORK.

The bluejackets from H. M. S. Minerva landed at Messina, and, as shown in this photograph, ably assisted the American and other foreign naval forces in the work of rescue.

Copyright, 1909, by Press Publishing Co., New York World.

PANORAMA OF BURNING MESSINA.

This photograph was taken, a few days after the great earthquake and tidal wave, from the sickel-shaped arm of land which encloses the harbor, and shows the fires burning fiercely in several parts of the desolated city.

Copyright, 1909, by Press Publishing Co., New York World.

SEARCHING RUINED HOMES AT MESSINA.

A guard stands in the foreground, while his fellow-soldiers are trying to locate possible survivors who may be buried among the debris.

CHAPTER III.

The Historic Cities of Sicily. Their Settlement by the Ancient Greeks and Carthaginians and Their Later Annals.

FAMOUS cities dot the coast of Sicily, some of them being among the most ancient of cities, coming down to us from that remote and largely legendary time when Greece was just making its young force felt in distant realms, and Carthage, the greatest of the colonies of old Tyre, was winning the rank of the greatest of commercial cities, the mistress of the Mediterranean. Most renowned in history of these cities is Syracuse, now shrunk in population to some 32,000, yet once playing a large part in the world's annals. Equally ancient, and now more important, is Messina, the chief seat of the great disaster with which we are here specially concerned. This city, with its 150,000 population, is of the same size as Catania, but is largely exceeded by the great mart of Palermo, with a population of 310,000. Messina, as the centre of present interest, will be dealt with specially in the next chapter, yet some description of the other leading cities will be of interest and importance in this place.

Syracuse, the chief Greek city of ancient Sicily, had a checkered career of conquest, reconquest, growth, importance, and decay, and in one of its sieges was directly concerned with one of the chief events of ancient Greece, the fall of Athens from its proud supremacy

among the Greek cities. It was one of the earliest Greek settlements upon the island. There are various legends about its origin, but it is held as certain that it was founded about the year 735 B. C., by Archias of Corinth, as part of a joint enterprise with Corcyra. He found, however, a Phœnician settlement already there.

The first settlement was made on a small island called Ortygia, separated from the coast by a very narrow channel. It is a fact of some interest that Syracuse, after its 2000 years of existence, during which it spread to great size and importance, is to-day confined to its original site on the island of Ortygia, with about two and a half miles of circumference. A bridge formerly crossed the narrow channel between mainland and island, and this has now given way to a road, or rather a passage too wide for a road, the Plemmyrium of ancient times. Ortygia, therefore, is no longer an island, but a peninsula.

Of the early history of Syracuse we know very little, but after the beginning of the fifth century B. C. it grew rapidly into importance. Under the rule of Gelon, famous for his victory over the Carthaginians, it spread to the mainland, Ortygia remaining the inner city, the stronghold of the ruler. In those days the island was too small to contain the whole population, and the great tombs, the Greek theatre, the Roman amphitheatre, and other structures of importance were built on the mainland.

The victory spoken of, that of Himera in 480 B. C., put an end to Carthaginian supremacy, and the great era of Greek sway in Sicily began. Gradually three populous quarters were added to the city, which became one of the great cities of ancient days, its public edifices including a temple of Zeus Olympias, a splendid statue of Sappho, the Greek poetess, and fine monuments to Timoleon and Dionysius.

Hiero, who succeeded Gelon, did much to foster art and civilization, and men of genius, such as the dramatist Aeschylus, the poet Pindar, and others, dwelt for a time under his favoring rule. At a later period Sicily enjoyed a free and democratic government, and during this period the celebrated siege by the Athenians, above alluded to, took place (415-414 B. C.).

The story of this famous contest and its direful results is far too long to be given here. It must suffice to say that a fierce assault ended in a complete defeat of the Athenians and the closing of the mouth of the harbor by a line of Syracuse ships, so as to prevent the escape of the Greek fleet. A terrible engagement ensued, in which the one hundred and ten Athenian ships remaining were reduced to sixty, and the sailors, their spirit broken, refused to attempt to cut their way through the Syracusan line and determined to land and make their way through Sicily. It was a wretched and hopeless expedient. The Athenian army, 40,000 in number, largely destitute of provisions, and many of the men sick or wounded, were destined to ill fate. Cut off in their march and surrounded by superior forces, they fought until, at the end of the sixth day, but 9,000 of the 40,000 remained. Then came the surrender and the wretched fate of these captives, who were treated with shameful inhumanity by the Syracusan victors. Near the city were deep stone quarries into which the greater part of the prisoners were lowered, and left in that confined space, lying upon one another without the least protection or convenience.

Escape was impossible, and for food each received daily a ration of one pint of wheat bread and half a pint of water, not half enough to save them from hunger and thirst, while they were daily taunted with the gibes of the Syracusan populace, who looked down

on them from above. Many of them speedily died, the captors not taking the trouble to remove the decaying corpses. In this terrible prison they remained for seventy days, when all were removed and sold for slaves except the native Athenians and the few Italian and Sicilian Greeks, who were left in the wretched hole. What became of them in the end we are not told. As regards Athens, it was so weakened by the loss of this large army of its best warriors and of its large fleet, that it fell before the assault of Sparta and lost its proud supremacy in Greece.

Nine years after this dire event the democratic government of Sicily was overthrown by a tyrant named Dionysius, who ruled the people with an iron hand, but during his forty years' reign added greatly to the strength and importance of the city, surrounding it with fortifications and constructing large docks. His war with Carthage in 397 B. C., added greatly to the renown of the city.

The noblest of all the rulers of Sicily was Timoleon, a Greek of Corinth, who went to that island in 344 B. C., to endeavor to restore the liberty of the Greek cities and drive out the Carthaginians. He landed, overthrew Hicetas, one of the tyrants, and in the following year made himself master of Syracuse. Hicetas induced Carthage to send a large army into the island, but Timoleon met this force with 12,000 men, only one-seventh of its number, and routed it completely, the gods—or the weather—aiding him by driving a blinding storm of hail into the faces of the enemy. Timoleon afterward drove out all the tyrants and gave free government to all the Greek cities on the island. Then, with a moderation that has had few examples in history, he gave up all his power and authority and settled as a private citizen in Syracuse, enjoying the love and admiration of the whole Greek world until his death, six years after his landing on the island.

Twenty years later the despotism was restored by a successful soldier and continued for more than a century, when Syracuse fell a prey to the growing power of Rome. The story of the siege (214-212 B. C.) is famous for the aid given by the great mathematician Archimedes in the defense of the city. During the siege by the Romans this celebrated scientist and engineer almost wore out the patience of Rome by his ingenuity in defense. He constructed a number of great machines for destroying the Roman works and ships, and the improbable story is told of his setting fire to the Roman fleet by the aid of mirrors.

The dramatic part of his story is the following: When, at length, the Romans took the city by surprise, their general was very anxious to save the life of the great mathematician, whose renown had spread throughout the civilized world. The tradition relates that when the Romans rushed in Archimedes, heedless of danger, was seated in the public square in deep thought, a series of geometrical figures being drawn around him in the sand. Seeing a Roman soldier rushing upon him, sword in hand, he called out to him not to spoil the circle. But the rude soldier cut him down.

Such is the early history of Syracuse. Under the Roman rule its importance fell away and it slowly declined, though its handsome public building and its artistic and intellectual culture made it for centuries still the foremost city of Sicily. Its fate came in 878 A. D., when the Saracens, who had invaded the island, captured this great city, which they pillaged and burned, leaving it a mass of ruins. From this misfortune it never recovered, sinking into complete decay. To-day it is a slow, sleepy, ugly and dirty town, without even the attraction of a picturesque situation, and with little trace of its ancient glory, beyond its Greek theatre, which is the

largest and most important in Sicily, and some other relics of its storied past. No one entering it to-day would dream that it had ever been, as Cicero describes it, "the largest of Greek and the most beautiful of all cities."

A feature of the past which still remains is the famous fountain of Arethusa, which, though lying within a few feet of the sea-shore, long gave forth the purest and sweetest of waters. This is no longer the case, for an earthquake destroyed its purity and the water is now brackish. Yet about this fountain centres a pretty mythological legend, which is well worth telling. Thus it runs:

There was a river god Alpheus, the deity of the Alpheus river, the chief stream of Peloponnesus. In its waters bathed the nymph Arethusa, and was seen by the god of the stream, who loved and wooed her so ardently, that she, who did not return his love, sought desperately to escape his pursuit. In her extremity she prayed to Artemis, who changed her into a fountain, and opened a passage for her under the sea to the Sicilian isle of Ortygia. The river pursued her, without mingling its waters with the sea, and came to the surface again in the spring which bubbles up by the island shore, close to the fountain of Arethusa.

Much space has here been given to Syracuse, not from any importance which it now possesses, but from its greatness in the past, when it was the capital of the monarchs of Sicily, its history being largely that of the island. It was a favorite place of residence or visit for some of the famous Greek writers, such as Aeschylus and Pindar, above named, and also Plato, who dwelt there long enough to offend the tyrant Dionysius by his freedom of speech, who at first threatened his life and afterward sold him as a slave. He visited Syracuse twice more, during the reign of the younger Dionysius.

In addition to these visitors, Syracuse had the honor of being the birthplace of the most famous pastoral poet of antiquity, the renowned Theocritus, whose splendid idyls are among the choicest treasures of the poetic world. It was the charm of rural life in rare Sicily that Theocritus sang, and with a richness and sweetness that remain unsurpassed. It is in such glimpses as this that our poet pictures for us the charm of his native land:

"There we lay
Half-buried in a world of fragrant reed
And fresh-cut vine leaves; who so glad as we;
A wealth of elm and poplar shook o'erhead;
Hard by, a sacred spring flowed gurgling on
From the Nymph's grot, and in the sombre boughs
The sweet cicada chirped laboriously.
Hid in the thick thorn-bushes far away
The treefrog's note was heard; the crested lark
Sang with the goldfinch; turtles made their moan,
And o'er the fountain hung the gilded bee.
All of rich summer smacked, of autumn all;
Pears at our feet, and apples at our side
Rolled in luxuriance; branches on the ground
Sprawled, overweighted with damsons; while we brushed
From the cask's head the crust of four long years."

In the records of Sicily we find the histories of many other towns and cities of ancient fame, from Naxos, settled as long ago as 735 B. C. Of these, we must confine our descriptions to a few of the more important, and must leave Messina, from its present thrilling interest, for a separate chapter.

Chief among the Sicilian cities of the present day is Palermo, an active seaport and commercial centre of its northwest corner.

Formerly the capital of the island, its population of 310,000 raises it to the rank of the fifth city of Italy in numbers, though scarcely so in fame. It occupies a picturesque site, at the mouth of a fertile valley called the Conca doro ("Golden Shell"), with mountains in its rear and a beautiful bay in its front. It has handsome streets and many fine old buildings, the oldest of its public edifices dating from the Norman period and belonging to two styles of architecture, the Saracenic and the Byzantine. Most attractive among them is the cathedral of St. Rosalia, built 1169-85. There is also the royal palace, with magnificent mosaics, and various other striking buildings.

As a shipping port, Palermo does an important business in the fruits and other agricultural products of the island, and in imports from other lands, and has a coasting trade of some importance. Though it has taken the place of Syracuse, it ranks far below it in historical importance. It has had its history, however, and has passed through the ravages of war. All this may be briefly described.

In origin it dates far back, the first we know of it being as a Phœnician colony and the stronghold in Sicily of Carthage. It was then known by the name of Panormus. Pyrrhus, the Greek invader of Roman Italy, conquered it in 276 B. C., and it was afterward taken by all the invaders of the isle, by the Romans in 254 B. C., the Vandals in 440 A. D., Belisarius in 535, the Saracens in 835, the Pisans in 1063, and the Normans in 1071.

The latter made it the capital of their kingdom of Sicily, and it remained such under later holders. In 1820 and again in 1848 it revolted from the Bourbon kings of Naples, and it was freed from them by Garibaldi in 1860, since which time it has been only a

provincial capital. It has not escaped the ravages of the earthquake demon to which its country is subject, having suffered severely from this evil in 1693, 1726, and 1823. In the 1908 terror it was too far beyond the area of peril to feel more than a trifling quiver.

Next to Palermo in size come two other cities, Catania and Messina, which on Christmas day of 1908 were almost exactly equal in population, having about 150,000 each. Three days later Messina had practically been wiped off the face of the earth, the great majority of its inhabitants dead or dying beneath its ruins, and Catania stood without rival as the second city of Sicily.

This distinction in fate is in a measure surprising, since Catania stands at the southern foot of Mount Etna, the danger point of the island, while Messina lies many miles to the north. Catania, indeed, has not escaped the visitations of its terrible neighbor in the past, but the present disaster was confined to the northeast section of Sicily and beautiful Catania remained unharmed. It has not always had this good fortune. It was destroyed by an earthquake in 1169, and five hundred years later, in 1669, was again severely shaken and threatened with utter destruction by a river of molten lava. The story of this visitation and the efforts to stop its ravages are told in chapter 23 of this work, and we need here speak only of another eruption and earthquake in 1693, which again almost destroyed the city. On this occasion its fine harbor was choked by a stream of lava, and it is still unsafe, although a mole to improve it has been built at great expense.

Since that date it has stood secure, and is to-day the finest and handsomest city in Sicily, it being built on a beautiful and consistent plan, to the details of which every builder is obliged to conform. From the sea it has a most attractive apearance, and this is not lost

to those who tread its streets, which are straight and wide and finely paved with blocks of lava, the most abundant building material in its vicinity. Lava, with trimmings of limestone and marble, is used in its public buildings, which are spacious and handsome, as are also many of its private residences. The finest of its squares, that in front of the cathedral, has for ornament an ancient statue in lava of an elephant bearing a granite obelisk. The cathedral mentioned holds first place among its many churches, it being founded by Roger I., the Norman, in 1091, but largely rebuilt since the earthquake of 1693. The great Benedictine abbey of San Nicolo occupies an area of twenty-one acres, there being not more than two or three buildings of the same kind in Europe to be compared with it. Its church is remarkable for a grand organ, with seventy-two stops and 2,916 pipes, built by Donato del Piano in 1760.

Back of the city spreads the fine Catanian plain, the only one of any large extent on the island. Fertile and well-cultivated, extending far along the southeast base of the great volcano, it is known as "the granary of Sicily," and largely to it the city owes its complimentary title of "La Bella Catania." Aside from all questions of beauty and attractive situation, the city is very active commercially, its people being distinguished for their industry and enterprise. It has manufactures of silk and linen goods, and of articles in lava, wood, amber, etc., while its exports embrace these manufactures and also sulphur, olives, grain, and other products of its fertile plain.

Like all the important cities in Sicily, Catania has a history going back to far ancient times. Under its old name of Catana, it was founded by a Greek colony from the neighboring city of Naxos about 730 B. C., which, once of importance, has long since

36935

ceased to exist. Catana maintained its independence until 476 B. C., when it was in a flourishing condition, but met with a sad reverse at the hands of Hiero I., who took it, removed its inhabitants to Leontini, and repeopled it with ten thousand Greeks and Syracusans, changing its name to Aetria. This change did not last long. Hiero died, the old citizens returned, got possession of their city, and restored its name of Catana.

It had other misfortunes. It was taken by the Athenians under Nicias, and later by Dionysius of Syracuse, who plundered the city, sold its inhabitants for slaves, and planted there a body of mercenaries from Campania. Under the Romans it regained its old importance, and in the time of Cicero was a flourishing and wealthy city, but in later wars suffered so severely that Augustus had to repeople it. Later the Goths plundered it, it was sacked by the Saracens, was conquered from them by the Normans, was ravaged by the emperor Henry IV, and was several times besieged in the fourteenth century.

Despite all the disasters from war and earthquake which Catania has suffered, many relics of ancient grandeur exist, the remains from the Roman times being numerous and extensive. These include a theatre, an amphitheatre, an odeum, baths, tombs, and fragments of a temple ascribed to Ceres. Lava has buried much of the theatre, and the remainder has served as a quarry for more modern buildings.

We might go on indefinitely describing places of ancient fame in Sicily, most of them now insignificant places. Among those we cannot pass by the Greek Akragas, the Roman Agrigentum, the modern Girgenti. Now a town of about 20,000 inhabitants, it was of old the second city in Sicily, with about 200,000 inhabitants, and a wealth and commerce that surpassed those of Syracuse. The

temples of Agrigentum were on the grandest scale of magnificence, scarcely equalled elsewhere in Sicily. Chief among them was the noble temple of the Olympic Zeus, 340 feet long. Of this only some fragments remain, but of the others there are numerous and splendid ruins, the best preserved among them being the Temple of Concord. Long independent, and possessing a territory which extended across the island, disaster fell upon it in 406 B. C., when it was taken by the Carthaginians and utterly destroyed. It never regained its old importance.

As a town, the Girgenti of to-day owes its attraction chiefly to its ruins and the beauty of its situation. It is so old fashioned that its best hotel has to send to Palermo,—six hours by train—for butter and meat. But when spring comes Girgenti is a dream of beauty, with its thousands of almond trees, snow-clad with blossoms, the tender green of its wheat fields, the scent of orange blossoms perfuming the air, wild flowers blooming everywhere, color, perfume, warmth, all that can fill the soul with enjoyment, while the rugged temples of the past rise to give an old-world grandeur to the scene.

For temples, however, we must go to Selinus, in the vicinity of modern Castelvetrano, where are to be seen the ruins of six vast Doric structures, some of them among the largest known. The Temple of Apollo, said to be the largest ever built, was 371 feet long and, including its steps, 177 feet wide. Its columns were 53½ feet high and 11¼ feet in diameter at base. As they lie to-day, it takes the arm-stretch of six or seven men to reach around one of them. This temple, built about 2,500 years ago, was never finished, as its columns to-day show.

Bædeker speaks of Selinus as the "grandest ancient ruins in Europe." They are not erect, like some of those at Girgenti, but

lie in rows of fallen columns whose vastness holds us spell-bound with wonder and awe. There are sculptures among them, big, ungainly, lacking grace, but of interest from the fact that they rank with the most ancient Greek sculptures known. When one gazes at all this, seemingly the work of giant hands, the amazement of it all is that these old builders, destitute of our sources of power and mechanical expedients, could have had the hardihood to undertake such vast labors and the perseverance to succeed. If the whole modern world were overthrown by an all-embracing earthquake, it would leave no ruins to compare with those that have come down to us from the past.

Let us visit another Sicilian city in our journey over the island, one well-known as a place of resort for American tourists, the modern Taormina, the old-time Tauromenium. This town was built about 385 B. C., and of it many relics remain, including an aqueduct, tesselated pavements, and what is left of a theatre which is regarded as one of the most splendid ruins in Sicily, and the site of which commands a view of almost unparalleled magnificence.

Taormina, lying 35 miles southwest of Messina and not far north of Etna, was one of the towns at first reported destroyed by the recent earthquake. It fortunately escaped with nothing worse than a terrifying shake, luckily for the foreign residents, for whom it has long been a favorite place of resort. Standing, as it does, on a rock 900 feet above the sea, it seems perched like an eagle's nest in the air, and is at once beautiful to look at from a distance and commands a grand and highly attractive view.

To Taormina hastens every visitor from abroad, drawn by its reputation of being one of the most lovely spots on the earth. When Ruskin was an old man, not long before his death, he told a relative

that the one spot on earth he would wish to see again, before leaving this lower realm, was rock-perched Taormina; and many there are who would share with him this wish. With the sea spread far and wide before it, the huge pile of Etna in near view, all the charm of color, of light and shade, and of picturesque views on every side, it is not surprising that artists haunt the place, busy in transferring to the canvas the many artistic points of view which find hosts of admirers.

We might go on indefinitely seeking to give in words the charm of Sicily and the interest attaching to its many historic sites. We must round up this chapter, however, with a quotation from Mrs. Alec-Tweedie's "Sunny Sicily," in which are given her impressions of the chief attraction of the isle.

"What is the chief charm of Sicily? Surely its varied coloring. It is an artist's paradise. Again and again we revelled in the soft grays of the olive, prickly pear, aloe, cactus, and fig; the pink of the peach and almond blossom; the yellow of the orange, lemon, broom and gorse; the green of the palm and date, banana and wheat; the carpet of wild flowers of every hue; and then the colors of sea and sky, the bright shawls of the women, the red scarfs and blue capes of the men, the scarlet cotton umbrellas and gay donkey harness, the smartly painted carts of Palermo, the vivid uniforms of the gendarmes—color, color, color everywhere.

"It is this color, with quickly changing sky effects, that constitutes the charm. One may stay for days in a place, and yet every day that place looks different; every hour it seems to change. Nature has many moods, and each has its fascination. Sometimes the sky is of oriental blue, and the heat tropical, then everything reminds one of hotter climes; sometimes grey mists and dull haze over-

spread everything, and we fancy ourselves back in northern Europe; or, again, a windy sky, with quickly chasing clouds passing over a rough, wild sea, makes us forget we are in Sunny Sicily at all. Yes; its color and its climate—those are its greatest charms.

"Sicily is a kaleidoscope of beautiful pictures."

And the attraction of the island is not alone that of rich landscape effects, brilliant coloring, warm sunshine, luxuriant vegetation. There is much in its story to attract the historian, much in its architectural remains to enchant the antiquarian. All the nations of the Mediterranean, the Greeks, the Carthaginians, the Romans, the Saracens, and even the Normans from the far North, have built upon its shores and left fine examples of their varied architecture scattered over its hills and valleys. And all of them have fought upon its soil, struggled for possession of its coveted territory, so that there is hardly a spot upon the island without its history, and it is probable that Sicily has witnessed more struggles for possession of its domain than any other area of land of its size upon the face of the earth.

CHAPTER IV.

The Story of Messina and Reggio, the Doomed Cities of the Straits.

THE city of Messina, or what was the city of Messina before the earthquake demon swept it from the face of the earth, has a history in which earthquake evils played a prominent part in the past as in the present. On Christmas day of 1908 an active, bustling, happy community, stirring with trade and thronged with a busy population, engaged in the multifarious duties incident to the life of a commercial city, on New Year's day of 1909 it lay a heap of ruins, under which weltered in their blood a vast multitude of dead and wounded, the latter the more unfortunate of the two, from the terrible suffering which their situation entailed upon them.

The disaster which overwhelmed this City of the Straits, however, must be left for later chapters, as we are concerned here merely with its history and situation. Messina is very picturesquely placed, lying between the sea and a range of sharp and rugged hills, the Dinnamare range, which rise to a height of 3700 feet. Running round the harbor in a semicircle, the town as seen from the sea, until recently, presented a very attractive aspect, the houses rising tier after tier upon the slope of the hills behind it, which climbed in the distance to lofty and wooded summits. Looking from this background across the Straits, the coast of Italy is easily visible, it being only four miles distant at this point. Elsewhere the channel of sep-

Copyright, 1909, by Press Publishing Co., New York World.

REFUGEES GOING TO THE QUAY AT MESSINA.

All that the inhabitants could save they carried with them out of the devastation. The bags are filled with their effects and one man has been lucky enough to have his goat spared him.

Copyright, 1909, by the Press Publishing Co., New York World.

HUDDLED IN A PLACE OF SAFETY.

Survivors of the earthquake at Messina waiting with the patience of peasants for relief to arrive.

Copyright, 1909, by Press Publishing Co., New York World.

WAITING FOR THE TRAIN AT MESSINA.

This pathetic photograph was taken at the railway station, showing some destitute women and children, with the little they could save, ready to speed away to begin life anew.

Copyright, 1902, by W. E. Scull.

BURNING THE BODIES IN THE STREETS OF ST. PIERRE AFTER THE GREAT DISASTER OF MAY 8, 1902.

Such heroic measures as here depicted are necessary consequences of the destructive upheavals of Nature.

aration between Italy and Sicily narrows until it is no more than half this width. Yet the waters between lie deep, as if some giant hand had scored a vast and profound ravine between the two ranges of coast land.

Messina owes largely its prominence as the second city of Sicily to the excellence of its harbor, which is the main element in its commercial prosperity. This is formed as if nature had intended this spot for the site of a flourishing community. A tongue of low land runs out from the shore and curves round in the shape of a sickle, enclosing a round basin, of about a square mile in area, open only to the north, the entrance channel being about 500 yards wide. The basin is deep enough for the largest ships to lie in safety in its waters, and the city is visited annually by more than 10,000 steam and sailing vessels, the carriers of its extensive commerce.

The name of Messina is familar in our country from the excellent oranges to which it is attached, and of which large numbers annually reach our shores. Lemons and raisins help to make up its trade, together with wine, oil, liquorice and hides, the product of the fertile island. Trading is the chief business of the place, its only manufactures of importance being silk goods. But its situation is favorable to the pursuits of the fisherman, and many of the inhabitants long made this their vocation, tunny being their chief catch, though sword-fish are captured in the Straits during July and August, the harpoon being used in this fishery. Valuable coral beds also lie beneath the waters and many of the people engage in the pursuit of this treasure of the depths.

Before its catastrophe, indeed, Messina was, next to Palermo, the chief commercial city of Sicily, with about 150,000 inhabitants. Including in this count the surrounding country and small

suburbs adjacent it approximates 200,000. It is the seat of an appellate court and is an archbishopric, and boasts a university unexcelled elsewhere in Sicily. Its university is situated on the Faro, or Stretta de Messina, a promontory due north of the city of Messina, which juts into the straits and reaches nearer to Calabria than at any other point. Directly across from the Promontory de Faro is the great Calabrian rock Scilla, over which is the town Scilla. This rock and the whirlpool beneath it, formed the direful Scylla of Greek mythology, which, with the Charybdis of eddies and unbridled currents in the straits, were thought by the ancients to be fraught with infinite danger. These cross currents have in recent years been greatly tamed, and Scilla is a delightful little port with no reminiscent suggestion of her quondam horrors.

On the Sicilian shore of these tumultuous straits is a range of rugged peaks. They lend dignity and grandeur to the wide stretches of scenery and are second in all Sicily only to Palermo.

WHAT MESSINA IS LIKE.

Messina was, comparatively speaking, well constructed throughout. It has several beautiful streets, chief among which is the Via Garibaldi, named after this soldier's memorable invasion of Sicily, when Messina was his point of attack. About the edge of the brilliant harbor runs the Marino, or Corso Vittorio Emmanuele. Parallel to the Marino and the Via Garibaldi are the Corso Cavour and the Via dei Monasteri.

The original city lay between the torrents of Portalegni, but it was extended north and south under Charles V., and has since incorporated within itself the suburbs of Zaera and San Leo.

Owing to the frequency of attack made upon the city by the

warring elements about her, Messina contains fewer relics of antiquity than any other ancient Sicilian city.

Foremost in its list of attractions is the Cathedral of La Matrice, an edifice of the Norman period begun in 1098. Parts of it are still standing as originally built, but as a whole it has been almost entirely rebuilt, owing to the destructive effects upon it of successive earthquakes. Like the town, the cathedral has had many vicissitudes and bears the marks of most of them. In 1254 it was damaged by fire which broke out in the course of the funeral of Conrad IV. In 1559 the spire of the campanile was burned down. In 1783 the campanile and the transept were overthrown by an earthquake.

All of the parts of this old edifice authentically of the past are the portals of the facade, indescribably enriched by carving in stone, and still more celebrated twelfth century mosaics, which were counted unequalled in Italy. From far and near the pious wended to La Matrice to lay votive offerings on the various altars to propitiate Providence in favor of the sailor folk. The trait is inherited from the Pagan forefathers of the island, since a Temple of Neptune that existed near the city attested that the sailor folk used to deposit offerings to the sea god to save the mariners from the demons of Scylla and Charybdis hard by the city in the strait beyond. Twenty-six columns from this Neptune temple were used in erecting the cathedral of St. Matrice.

The cathedral has also a gorgeous high-altar and *baldacchino,* while its choicest treasure is a letter claimed to have been written by the Virgin Mary to the townsmen. Its splendid mosaics are rivalled by those in the two other old churches of St. Gregory and St. Niccola.

Other buildings of past times are the citadel, built by Charles II,

of Spain in 1680, the Gonzago Castle, dating from 1140, and another castle of almost equal antiquity. The remaining important buildings, the handsome theatre, the palaces, and the official buildings, are for the most part modern—or rather *were,* for they have largely ceased to be. Among them we may name a university originally founded as long ago as 1549, a college of the fine arts, an academy of the arts and sciences, scientific collections, and technical schools.

MESSINA LA NOBILA.

"Messina la Nobila" presented to the curious eye only another form of the well built modern Italian city. In fact, the inexpressible grandeur of the scenery, the vine-terraced mountains, the purple fumes arising from Etna, the enchantingly graceful outlines of the four-mile crescent forming the harbor, so eclipsed all human work, that the city made little impression. Situated right at the water's edge, with no possible means of sea defence, Messina was always the first point assaulted by the covetous races bent on possessing the key to the Mediterranean. Hence, Messina, though its site is one of the oldest of those of the southern cities, was the most modern of the capitals identified with successive races. Without the relics of antiquity, Messina possessed only the charm of its delicious climate, its gay street life and the bewildering vistas seen from the successive parterres of vine-clad loveliness winding skyward. There had been relics of Grecian, Saracen, Norman and Roman citadels, amphitheatres and what not until the unspeakable Bomba let loose his demoniac soldiery in 1848 to put down the insurrectionary forces bent upon forming a civilized system on the island. After the bombardment by his troops and the consequent destruction, its antique ruins had largely ceased to be.

Messina's people were scattered along the narrow fringe of land between the foot hills and the curving beach, hence the swift destruction that followed the invasion of the "thirty-five feet of water" that is described as rising after the few seconds of shock that tumbled the walls and slaughtered the sleeping victims. Not long ago a very perfect system of seismographic instruments were set up along the coast to give warning to threatened cities; the mechanism was so ingenious that scientific folk have travelled from far and near to watch its astonishing accuracy, its almost supernatural sensitiveness to the slightest earth tremors. Its warnings, however, were of no avail against such sudden shocks as that with whose results we are now concerned. Disasters which come in the dead of night and complete their work of destruction while the second-hand of the clock is half completing its brief round leave no time for the most complete seismograph to give notice, and whatever may have been its value to science, the Messinian instrument was of no use to the threatened inhabitants.

ANTIQUITY OF MESSINA.

The history of Messina begins very early in the Greek era. It was founded in 732 B. C., by pirates from Cumæ and Chalcidia, but this was not its first appearance, for an ancient Sikelian town occupied the site on which these piratical invaders settled, drawn thither, doubtless, from its splendid adaptation to sea-faring purposes and its convenient nearness to Italy. They named the place Zancle (a sickle) from the shape of its harbor, its title of Messina coming several centuries later.

Eighty years afterward the town had become so prosperous as to be able to sent out a colony of its own, which settled at Himera.

A new influx of inhabitants came after the Persian conquest of the Greek domain in Asia Minor in 494 B. C., fugitives from Samos and Miletus sailing thither and taking possession of the city. A year later came another change in its fortunes, when Anaxilas, the tyrant ruler of Rhegium on the Calabrian shore, seized the place and peopled it by a colony of Messenians from the Peloponnesus. These, to keep with them a memory of their home, changed the name of the place to Messana, the Doric progenitor of the present title.

About thirty years later the sons of Anaxilas were expelled by the rebellious citizens and their old republican government was restored. Under this home rule the city continued for the following seventy years, it taking no part in the great war between Athens and Syracuse, the effects of which were felt widely throughout Sicily.

Its greatest ancient disaster came in 396 B. C., when the Carthaginians, during their wars with Dionysius of Syracuse, captured it, and destroyed it so utterly that it had to be entirely rebuilt. This was done by Dionysius, who drove out the foreign foe and made the place a part of his extended kingdom. During the next fifty years Messina had several changes of masters, until in 343 came Timoleon, the great Greek deliverer, who put an end finally to the Carthaginian occupation of the city.

The next important era in the history of Messina was that of the first Punic war, between Rome and Carthage. The Syracusans and Carthaginians were then at war in the island and the fierce struggles that followed led to an appeal to Rome for aid which was quickly responded to. In this way Messina was concerned in the origin of the long and desperate conflict between the two great warlike republics of that age. At the close of what is known as the first Punic war, the early era of that great struggle (241 B. C.),

Messina came under the control of Rome, and remained so until the fall of the empire.

Even then it did not escape the ravages of war. During the civil wars that followed the assassination of Julius Cæsar, Messina was one of the cities that supported Sextus Pompeius. As a result it was taken by Octavian in 35 B. C., and sacked by his troops. When he became emperor, as Augustus Cæsar, he founded a colony there, and for centuries thereafter it flourished as a trading port as it had done for centuries before.

MESSINA'S LATER HISTORY.

The most important event in the history of Messina came after eight centuries of relief from war's vicissitudes. The Saracens had now made their power felt in northen Africa and invaded Sicily from Tunis, rapidly gaining control in the island. Messina fell into their hands, and was held by them for more than two centuries, when the Normans came to dispute their dominion in Sicily, Messina being the first permanent conquest made by them. This was in 1061 A. D. The Crusades soon followed and Messina reaped a harvest from them, it being a favorite place of rendezvous for Christian soldiers on their way to dispute the ownership of the Holy Land with the Saracens.

Misfortune came to it, however, in 1190, when the burly and hot-headed Richard Cœur de Lion stopped there with his crusading army. He spent six months in the city and, as usual with him, got into a quarrel with Tancred, the last of the Norman rulers, and let his soldiers loose on the town. They sacked it in the thorough manner of the warriors of fortune of that day. Four years later Messina, with the rest of Sicily, came under the control of Henry VI., the German emperor.

After a period of German occupation the French became dominant in Sicily, and held it till 1282, the year of the Sicilian Vespers, when the people rose and drove the invaders from their land. In the war that followed, Charles of Anjou besieged Messina, but its people boldly and bravely defended their city, and for once in its history it repelled an invading army.

In 1282 Spain became dominant, and held Messina until 1713, a period of more than four centuries. Here the fleet fitted out by the Holy League against the Turkish lords of the Mediterranean assembled in 1571, under Don John of Austria, and set out for its great victory at Lepanto. He returned thither with his victorious fleet and celebrated his success with a triumph in the city. To commemorate his visit a statue in his honor was erected in the Piazza dell' Annuziata.

For a century after this Messina enjoyed great prosperity, but an ill destiny was at hand, due to internal dissensions which ended in destroying its commercial importance. In 1674 a bitter struggle broke out between the aristocratic faction, or Merli, and the democratic faction, or Mavizzi. The democratic faction appealed to the French and the other to the Spaniards. The former faction were at first victorious, but eventually were deserted by the French, the city was taken by the Spaniards, and when the struggle was over the population was reduced from 120,000 to about a tenth of that number.

The town never fully recovered from this disaster. Whatever recovery was made was neutralized in the eighteenth century by a series of disasters. In 1740 about 40,000 persons died of the plague, and in 1783 the town was almost entirely overthrown by the great earthquake of that year. Great damage was caused by bombard-

ment in September, 1848. The cholera carried off no fewer than 16,000 victims in 1854, and earthquakes in 1894 and 1906 also caused loss of life and property. In 1860 the town was occupied by Garibaldi. It became a part of united Italy the following year. It was the last city on the island taken from the Bourbons and brought under the rule of Victor Emmanuel.

REGGIO DI CALABRIA.

Across the Messinian straits to Reggio di Calabria, so called to distinguish it from Reggio nell'Emelia, is one of the prettiest trips between the two countries, that bridging the gulf between Sicily and Italy proper. In Reggio the devastation of the latest tragedy has been almost as widespread as in Messina, although Reggio is far smaller, and less important from the historical and artistic point of view.

It has been for the most part safely out of the path of the volcanic eruptions which have destroyed its Sicilian neighbors, though the earthquakes and tidal waves resultant upon Etna's upheaval have struck Reggio as hard as the rest. The district in which it is situated is the extreme toe of what is called the foot of Italy, the town being placed on the Italian side of the Straits of Messina, a few miles farther south than the city of that name. With 44,000 population before its recent disaster, Reggio is the capital of a province of the same name having about 430,000 inhabitants, very many of whom felt some severe effects from the recent earthquake.

Like so many of the cities of Sicily and southern Italy, Reggio owes its origin to the Greeks, being founded in 732 B. C. by a colony of fugitives from Messina, under the name of Rhegium. Prosperous in its early career, it suffered much in its later history from the

ravages of war. Anaxilas mastered it about 494 B. C., adding Messina soon to his dominion. In 399 B. C. Dionysius of Syracuse made an attack upon it which was the beginning of a protracted struggle, ending in 387 in its complete destruction and the sale of all its inhabitants as slaves.

It was restored by the second Dionysius, but in 280 B. C., during the war between Rome and Pyrrhus, admitted a Roman garrison, which revolted, killed all the men of the town, and held the place against the Romans for ten years. In the Middle Ages it was captured in succession by the Goths, the Saracens, the Pisans, the Normans and the Turks.

An interesting incident in its history is the visit there of Paul the Apostle in his voyage from Cæsarea to Rome. Mention of this is made in the Acts of the Apostles, and the fact is made known by an inscription from the Acts carved across the front of the Cathedral.

Reggio (pronounced Red'jo) suffered frightfully in the earthquake of 1783, the horror being so great that very little of the past appeared in the modern city which fell under earthquake throes in 1908.

The place, before its disaster, was one of many attractions. George Gissing, in his "By the Ionian Sea," speaks of its "regular streets, amphitheatre-wise, upon the slope that rises between shore and mountain. From the terrace road along the shore, Via Plutino, beauties and glories indescribable lie before one at every turn of the head. Aspromonte, with its forests and crags; the shining straits, sail-dotted, opening to a sea-horizon north and south, and, on the other side, the mountain-island, crowned with snow."

At Reggio, Sunday was market day and crowds of country folk came into town with the products of the soil. Stalls filled the

open spaces temporarily, the donkeys, ubiquitous beasts of burden there, being tethered during the hours of selling. Roundabout was a veritable garden spot, the vegetables being famous. There were cauliflowers with the white measuring over a foot across. Flowers were everywhere. The women on these days were quite as busy as the men. The female water-carrier poised on her head a long slim cask which rested on a pad. She suggested the Sicilienne who, after her husband had fought for and obtained a traveler's luggage, put it on her head and trudged off up the mountain-side with the newcomer while her marital partner remained to lounge at the wharf.

The Musea Civico contained a fine collection of terra cottas, lamps, vases, statuettes, and other examples of curious, early native art, now probably all destroyed. Among its most interesting works was a relief of women dancing of the sixth century B. C., with its architectural framework painted black, red and yellow. One of the far-famed Laocoon groups was also housed here.

In the piazza adjoining the railroad station was a fine statue of Garibaldi, under which a military band often played. Back of Reggio rises the imposing, forest-clad Aspromonte, due north of which is Scilla.

The smaller cities which are buried under the streams of lava or deluged with the slime and water of the tidal waves all bear the same general characteristics of the cities whose share of the burden was heaviest. All the small cities in Sicily and Calabria have kept their little quota of historical relics jealously guarded against invasion and sacrilege. Each has been forced to build over again the homes and streets in which its populace dwelt. Each has known the same tribulation, learned through long sojourn near Etna, the great monster of southern Italy and Sicily.

CHAPTER V.

The Frightful Earthquake of 1908 and Its Surpassing Horrors.

NO more delightful season comes to the people of the Christian nations in these later days than that of Christmas, the era of festivities, home gatherings, the giving of gifts and happy reunions of all kinds. It is the season in which no one is apt to dream of death and disaster, and on the Christmas of 1908 it is not likely that a single inhabitant of that portion of Italy surrounding the Straits of Messina had other thoughts than of enjoying the happy season to the utmost. All over the civilized earth, indeed, joy and good will reigned and gloom and disaster found no abiding place in men's minds.

Yet disaster impended, dire, deadly, earth-rending disaster; beneath the unquiet earth the demons of destruction were gathering, and to the old disasters of the region a new one of unprecedented horror was about to be added. A quiet Saturday and Sunday followed the day of festive enjoyments, and the people of the threatened district sank to their wonted rest, prepared to take up again the accustomed burden of life when the next day dawned.

Alas for them, and for all sympathetic souls, no day was ever again to dawn to the great majority of that slumbering multitude, no burden of life was again to be taken up, and for most of those whom death was not ready to claim, pain and agony, in many cases life-long, impended.

The night passed; the late hours preceding the dawn arrived; five o'clock came and passed and the whole city seemed buried in slumber, awaiting the hour near at hand when the sun would call it to life and activity again.

Suddenly, without a moment's warning, the earth's surface was lifted, houses and churches rocked and swayed, ceilings fell and buried the sleepers in their beds, falling floors carried the beds and their occupants alike to red ruin, walls crashed and tumbled, and before thirty seconds had passed the great city of Messina fell into almost utter ruin, burying vast numbers of its inhabitants in a grave from which they would never emerge.

A scene of universal horror succeeded the frightful catastrophe. Thousands of the people lay buried under the ruins, the most fortunate among them those who fell to sudden death and escaped the long agony that awaited many of those who lay under the fallen walls, terribly multilated and suffering untold tortures, or those who, while unhurt, were pinned fast by fallen beams, and saw with starting eyes the red flag of the flames which soon began to crawl towards them, licking the frightful spoil with red, devouring lips.

Few in comparison were those who gained the streets, clambering over piles of wreck, half clad or unclad, many of them bleeding from painful wounds, most of them so terror-stricken as to forget their hurts, to forget all but the instinct of flight. Screams of horror, demoniacal cries, moans of anguish filled the air, drowned frequently by the roar of falling walls, often filling the streets from side to side and crushing new victims among those who had safely fled from the first peril. And upon it all came a torrential downpour of rain, soaking and chilling the survivors and adding to the gruesome aspect of the frightful situation.

The sufferings of the people were awful to contemplate. Bodies were found which bore mute testimony of the torture endured before death relieved their sufferings. Several of these persons had died gnawing at their arms and hands, evidently delirious from pain and hunger. Other bodies brought from the ruins had portions of shawls and particles of clothing in the mouths, and one woman had her teeth firmly fixed in the leg of a dead baby.

MANY MIRACULOUS ESCAPES.

The stories related by the survivors in the hospitals, and at the food supply stations, where rations are issued twice a day, all reflect the horror of the fateful December 28. There were many miraculous escapes, but the cases of bereavement were without number. A cobbler named Francesco Missiano related that immediately after the first shock he and his wife and children rushed out into the street. Fires were breaking out all around them. Hearing groans from a pile of debris nearby the cobbler made a hurried examination. He found two girls dying. The head of one was split open, while the chest of the other had been crushed in.

The cobbler picked up a baby, but it expired in his arms. Seized with mad terror the man fled toward the sea. It took his party two hours and a half to traverse the heaps of ruins between his house and the water front. After placing his family in safety he returned to seek his mother and sisters, but he was obliged to give up the effort. It was impossible to make his way back to his home. During the thirty-six hours the cobbler passed among the ruins he did not see more than 5,000 or 6,000 survivors.

All of the survivors told dismal stories of the misery suffered by cold and hunger after their escape, and of the rarity of other

survivors seen in the streets and open places, so that often they believed themselves to be the only persons saved; of the dense, choking cloud of dust which hung over the city for a long time, obscuring their vision and adding to the horrors of their bewilderment; and of the greater horrors of the succeeding earthquake shocks, especially in the darkness, which seemed to forbid all hope of final escape. A tragic note was struck by an elderly couple, who described how they were imprisoned in the lower part of their ruined house. They could only cry for help and heard no answer, save other cries for help from the darkness around them.

It was impossible to pass through most of the streets, which were blocked in some places with huge mounds of fallen debris. Here and there bodies could be seen in inaccessible places, pinned in by beams or masonry and projecting from the upper stories of the houses, sometimes lying half buried and horribly contorted.

In front of the city the sea wall had broken up and fallen and the sea walk was sunk under water. Behind this were streets upon streets of fallen houses. In some places the appalling scene beggared all description; everywhere horrors beyond mention making the scene one fit for the pen of a Dante.

FREAKS OF THE DISASTER.

Curious freaks of the earthquake were everywhere to be observed. Standing walls had fallen out, exposing one tier of rooms above another in which nothing seemed to have been disturbed. Pictures hung straight on the walls, lamps were on tables and vases and flowers on mantelpieces. In one place two buzzards were sunning themselves on a window-ledge over the dead body of a woman, whose wealth of black hair covered her face and shoulders. Dogs and cats were killed by the soldiers whenever caught feeding on the

dead. The buildings that best resisted the shock were the old royal palace, now the prefecture, and the Archbishop's palace, where ten of the inmates lost their lives.

The survivors of the disaster were so dazed and worn out that they were quite incapable of describing their experiences connectedly, but the accounts of all agreed that the devastation was accomplished in less than one minute. All those capable of analyzing their sensations said that when the shock came they felt an upward thrust of the earth. This was followed by an oscillatory motion and the crust of the earth vibrated. A great and terrifying roar, like a series of subterranean thunder claps, accompanied the jumping, dancing, hurling about of everything movable, which was so severe that some of the survivors were flung from their beds three feet into the air several times before they could get upon their feet and make their way to the street by stumbling down crumbling stairways or dropping from windows upon the ruin below.

Early visitors to the scene found the streets of the wrecked city piled twenty or thirty feet high with debris. It was a wilderness of ruin a mile wide and two miles long. Beautiful churches, splendid villas in the foot-hills, hospitals, barracks and the university—all shared the common lot. Two-thirds of the magnificent Norman Cathedral, the pride of Messina, were in ruins, and little or nothing remained of the relics of Phœnician, Greek, Roman and Saracen architecture which marked the stages of Messina's centuries of tragic and tumultuous history.

THE RUINS OF REGGIO.

While attention was concentrated upon Messina, the inhabitants of many other towns and villages in Sicily and Calabria were suffering the same horrors. Chief among these was Reggio, a Calabrian

Copyright, 1909, by Press Publishing Co., New York World.

A MESSINA STREET FILLED WITH WRECKAGE.

Added to the horrors and perils of the tumbling houses was the blocking of many avenues of escape and rescue by such a condition in the narrow streets as is here depicted.

Copyright, 1909, by Press Publishing Co., New York World.

THE RUINED WATER FRONT OF MESSINA.

The building at the extreme right is the American Consulate. Looking along the quay, nothing appears but the desolation caused by earthquake and tidal wave.

Copyright, 1909, by Press Publishing Co., New York World.

SENDING SUPPLIES FROM NAPLES.

Soldiers and civilians are here shown boarding a steamer at Italy's chief southern city, to carry necessities to the Straits of Messina.

SEEKING REFUGE IN THE CATHEDRAL AT ST. PIERRE.
The last refuge from destruction, yet not a refuge.

city of one-third the size of Messina, and like the latter in the centre of the area of shock. News from this city came later than from Messina, but it was of the same tragic character.

The ominous absence of details concerning Reggio proved to be due to the fact that not only the city itself, but its whole population, with the exception of a mere handful, had disappeared.

A torpedo boat which ran close to the coast was unable to discover a trace of the city. Where, two days before, stood an aggregation of buildings and busy streets there was nothing seen but rocks and earth. The city had vanished as completely as Aladdin's palace under the magician's spell. The first idea was that Reggio was completely swallowed by the earth collapsing beneath it, and the yawning site was filled by the sea, which advanced in a huge wave, as at Messina. And this, while an exaggeration of the fact, was not wholly out of consonance with the situation. Refugees from this city confirmed in part this story of dreadful ravage, saying that the lower part of the city had been swallowed up, and that the public buildings, the churches, the barracks, the city hall, and most of the houses of the people were nothing but crumbled masses of ruins. Later tidings from Reggio told the same story of horror indescribable. For two days the survivors were cut off from the outer world. Looters took possession of the ruins, and ultimately respectable citizens were forced to arm themselves and fight for food to escape starvation.

CHASM EIGHTY FEET WIDE.

The station master at Reggio says that immediately after the first shock a chasm eighty feet wide was opened in the earth. From this there gushed forth a flood of boiling water, some jets rising to the height of an ordinary house. Many injured persons who were

in this vicinity were horribly scalded by the flowing stream, and these volumes of hot water continued to spout into the air for two days after the earthquake. The width of this fissure was doubtless exaggerated, but several remained twenty feet wide.

As the station master made his way to a place of safety he saw human limbs sticking from the masses of ruins. Frenzied relatives strove to free their dear ones from the fallen masonry, while shrieks from the miserable fugitives, rushing half naked and bleeding through the streets, filled the air.

The sea inundated the suburbs of Reggio and destroyed countless acres of orange groves. The smaller houses of the peasants completely disappeared, the receding waters leaving them buried in mire. Corpses were encountered everywhere in the outskirts of the city. The bridge near Pellaro was carried off by the sea, as were also entire sections of the railroad.

A young seminary student, Teodoro Rositani, who walked eleven miles to escape from Reggio, had a terrible tale to tell of the first moments of the earthquake, in which he lost a sister and another relative.

"Together with my companions," he said, "I was in a train waiting to go to San Giovanni, when the carriage was literally lifted off the tracks, the station crumbling to the ground before our eyes. We were soon climbing the heap of rubbish, all that was left of the station, guided by the cries of distress. We dragged forth the family of the station-master, all of whom were badly injured.

"Meanwhile the shocks continued and the sea gathered itself into a wall of water, destroying everything it touched. The sun had risen before we had completed our work of rescue at the station.

"We were roused from our work by the shouts and found our-

selves in the embrace of the rest of our companions, who had escaped from the seminary. In the joy of the reunion we all fell on our knees and gave thanks for our escape, praying also for our less fortunate townspeople."

DISASTER IN OTHER QUARTERS.

Messina and Reggio were the only large cities that felt the effects of the fearful quake. Palermo was too far off to be reached, and Catania, though very near Etna, was unhurt by the shock. Taormina, midway between Messina and Etna, and a favorite place of resort for American tourists, escaped with a light shake that did little damage, though the sea was strangely affected. But within the immediate zone of ruin were many small towns and villages which felt the full force of the shock and had as dire a tale of horrors to tell as had the larger cities.

The disturbance extended farther inland in Calabria than in Sicily, but most of the residents were concentrated along the coast line, where the configuration is not changed except within a few yards of the shore.

Scylla, San Giovanni and Reggio, in the order named, stretch from the north to the south along the coast line for about ten miles, with smaller hamlets between. The inhabitants of this line of greatest violence numbered about 70,000, of these Reggio alone lost 28,000, while similar destruction visited the other towns. San Giovanni was a prosperous manufacturing town, containing ten large silk mills, all of which were destroyed, with very many of their operatives.

Back from the coast were other towns, Bagnara, with 10,000 inhabitants; San L'Eufemia, with 6,000; Palmi, with 7,000, and

various others, all of which lost heavily. At Bagnara few houses were left standing and the city presented an aspect of terrible desolation. The Mezzacapo barracks at Reggio went down in utter ruin, nearly a whole regiment being buried beneath them. At a convent nearby some of the nuns and all the servants were killed, and of the sixty pupils only twelve escaped. Some of these jumped from windows and walked twenty-five miles in their night clothes in search of aid.

The centre of the disaster in Calabria seemed to be the region around Monte Leone, where every town and village had its gory roll of dead and wounded to chronicle. Thousands of people abandoned their homes, although a terrific rain storm prevailed, and filled the air with lamentations and prayers. In some places, such as Prizzo, Cotrone, Santa Severina and Piscopio, the people had the courage to enter the churches almost while they were falling, and carry out the Saints. They bore these in procession through the open country, invoking the mercy of God. In the mountainous regions inland the population took refuge in grottos and caves, where peasants and priests, soldiers and persons of gentle birth, dwelt in common. Their bed was the ground, and fires were kindled to keep off wild animals.

The radius of ruin and death extended back with decreasing intensity for forty miles on the mainland and thirty miles in Sicily, and a detachment of troops which went to the villages on the east coast of Calabria found nothing but ruins and the bodies of persons killed in the earthquake. The survivors had fled. There was every reason to believe that dreadful havoc was wrought in the mountain villages that had not yet been explored.

A report of technical observations from the observatory at Messina says the earthquake lasted for twenty-three seconds only.

It was accompanied by remarkable atmospheric phenomena. The surcharged air was filled with sparks and flashes of flame which flared up until the heavens seemed afire. The crest of the earth appeared suddenly to drop. These phenomena were followed by distinct lateral oscillations that threw the panic-stricken people off their feet as they rushed to the streets.

NOTHING COULD HAVE WITHSTOOD SHOCK.

Messina, like most Sicilian and southern Italian towns, was of tremendously solid construction. There was usually a facing of brick or stone, and behind this was a wall of rubble—a mixture of mortar and small stones—of enormous thickness. Three feet of this material was nothing unusual. The forces which nature brought to bear upon this construction show in the result that the buildings might as well have been made of sand in the same quantities, held together between surfaces of cardboard. This explains why the ruins of Messina made such an enormous mass. The buildings averaged four or five stories in height, and the scrap heaps that remained were at least two stories above the street level, including the material in the roadway itself.

Another peculiarity was the following. An earthquake has usually some general direction, north and south, east and west, or between these points. Not so this convulsion. The debris fell in all directions, and invariably into the street, unless the front walls failed to give way, in whatever direction the buildings faced. It was the vertical motion, apparently, that was most destructive. The horizontal shaking loosened everything, and then the violent tossing brought the whole construction to the ground.

Among the most lamented results of the disaster was that of

the destruction of the great cathedral, the pride of the city. It had suffered seriously in former convulsions, but in none so severely as in this, which left it almost an utter ruin. Its priceless relics of art and antiquity, representing the enormous value of $10,000,000, lay under the wreck, and its twenty-two splendid granite columns, said to have come from a temple of Neptune, near the Forum at Rome, lay prostrate and in shattered pieces. The remaining churches of the city suffered a like fate, and all the largest and best buildings of the city went down in irreparable ruin.

As for the loss of life from this dread disaster, it may probably never be known. The figures for Messina were estimated some weeks later at 108,000, and those for Reggio at 28,000. There remained those for Palmi, San Giovanni, Scylla, Gallina, Bagnara, Pellaro, and numerous other places, probably making the gruesome total not less than 200,000, possibly more. The principal hotel at Messina, much frequented by foreign tourists, proved a death trap for its many guests, among whom it was feared there were many Americans. It fortunately proved that none were there at the time, and the only loss to America was the greatly regretted one of the United States Consul Arthur S. Cheney and his wife, who were crushed to death in the fall of the consulate residence. Stuart K. Lupton, the Vice-Consul, was just then living in another house, and to this fact he owed his life.

It may be said in conclusion of this chapter that those who perished immediately or died under the ruins from their wounds formed only a part of the loss of life. Many of the rescued were so seriously injured that their recovery was hopeless, and fully 5,000 of them had died in the hospitals of the several cities within three weeks of the date of the disaster.

CHAPTER VI.

The Gigantic Tidal-wave and Its Sweeping Destruction.

IT was not alone the earthquake, but the seaquake,—a profound uplifting of the ocean bottom and pouring on shore of huge billows,—to which the destruction of the great Sicilian disaster was due. This irruption of the sea-waves and overflow of miles of inhabited country was one of the greatest in history, but preliminary to its description, some account of similar convulsions will doubtless prove of interest and value.

There are many interesting examples on record, of which that of the great earthquake at Lisbon was the most destructive to human life, while the convulsion which drowned so much of the city and so many of its inhabitants, was felt by vessels fifty miles distant on the Atlantic. In other cases ships eighty miles at sea have felt shocks that came like sudden blows on their bottoms, accompanied by a noise resembling "a dull rattle like thunder." This blow-like effect is common, it feeling in some cases as if the ship was grounding, in others like a number of sharp jerks on the cable. On February 10, 1716, the vessels in the harbor of New Pisco were so violently shaken that masts and ropes were broken, while the water lay still. Even cannon have been jerked up and down from the deck by these sudden blows of the underlying water.

In the instances stated there was no disturbance of the surface

of the water, but earthquakes have often been accompanied by waves of enormous size, as witnessed in the flooding of Messina and the drowning out of Reggio. In some cases the sea-wave has preceded the earthquake, as at Smyrna in 1852. At St. Thomas, in 1868, the convulsion began by the receding of the water. Then, after the land shock, the water returned in a wave so high as to lift the United States ship Monongahela and leave it high and dry on shore. In the same year another large United States ship, the Wateree, was swept a mile inland by the sea wave—or tidal wave, as these are commonly called—that inundated Arequipa. As regards the Lisbon earthquake, the waves ran from thirty to sixty feet high.

With this preliminary review of the subject, we shall describe the phenomena observed on the Sicilian and Calabrian coasts in the recent disaster, as told by eye-witnesses.

THE SWEEP OF THE WATERS.

At the time of the earthquake the torpedo boat Sappho was lying in the harbor at Messina, and one of the officers told of the occurrences as follows:

"At half past five in the morning the sea suddenly became terribly agitated, seeming literally to pick up our boat and shake it. Other crafts nearby were similarly treated, and the ships looked like bits of cork bobbing about in a tempest.

"Almost immediately a tidal wave of huge proportions swept across the strait, mounting the coasts and carrying everything before it. Scores of ships were damaged, and the Hungarian mail boat Andrassy parted her anchors and went crashing into other vessels. Messina bay was wiped out and the sea was soon covered with masses of wreckage, which was carried off in the arms of the receding waters."

At Riposto, south of Messina, the tidal wave was terrific. At first the sea receded for a great distance from the shore and then it swept forward with tremendous violence. The water, advancing in a huge wave, swept before it every house and building for a thousand feet from the shore line. The waters rushed through the streets of Riposto to a depth of from ten to twenty feet.

One observer tells his story of the sea spectacle in these vivid words:

"I looked seaward and was transfixed by the most terrifying sight of all. A wave was advancing toward the city that grew as it approached, until it seemed as high as the lighthouse. It tumbled the ships about like toys, turning them turtle or tossing them on their beam ends. It came with tremendous velocity, but it seemed an age to me before it swept over the lighthouse, tearing away the piers like paper and swallowing the shore front. Far inland it swept, extinguishing many of the fires."

In the narrow strait the water formed into a huge wave, thirty-two feet high. It then drew back from the coast as if gathering strength for an onslaught that would obliterate the land. So violent was the motion of the atmosphere coincident with the tidal wave that several workmen engaged in digging a pit on the Calabrian side of the strait were carried bodily up into the air.

Suddenly, stopping in its backward sweep, the waters of the strait hurled themselves upon the two coasts. Inexorably they advanced, and piers, houses and gardens were swallowed up in the flood. The ground for a great distance trembled under the shock of the impact. A naval officer who witnessed this awe-inspiring spectacle described it in these words:

"It seemed as if two mountains, one of water and the other of

land, fell furiously, the one towards the other, and as if the land vomited human inhabitants into the sea."

All along the straits similar scenes were witnessed. Reggio suffered frightfully. A captain of carabineers, who saw it shortly after the disaster, said:

"The town was not swallowed up by the earth as at first reported, but the sea rolled in a mighty wall of water and engulfed it. I don't think more than a few hundred escaped out of the entire population. I doubt if any one escaped in the lower part of the town, which is under the deepest water. The water receded from some of the higher points of the city. The lower part of the town is rapidly settling and it was feared when I left that it would drop into the sea."

Fortunately the disaster did not prove on later advices to be so complete as here stated, but with all ameliorations it was terrific and soul-harrowing. Later advices concerning it stated:

"The tidal wave that swept into Reggio flooded the city to a depth of thirty or forty feet above sea level. Some of the houses along the water front were swept from their foundations and dragged out to sea. Twelve miles of the railroad near Reggio were destroyed. A tempest added to the terror of the scene.

"The region between Rocella, Jonica and Caulonia, not far from Reggio, is still flooded. The sea front at Reggio has been completely swept away, according to statements of refugees. The harbor is filled with wreckage from vessels of every kind and it is impossible to approach Reggio by sea or by land.

"With the horrible inrush of the sea, the swallowing up of boats, the crushing of ships and the destruction of bridges and walls, the sea became almost instantly covered with debris containing refuse

of every description dotted with human bodies. When day dawned the entire shore line of the surrounding country was utterly changed in appearance. The coast line was greatly altered, while of all the magnificent houses along the shore only a few tottering ruins remained. From these ruins from time to time there sprang jets of flame and smoke."

At Catania the tidal wave sunk 500 boats and did great damage to several large vessels and steamers. At Messina a ferryboat moored at one of the docks seemed suddenly to be thrown high into the air. It landed on top of the dock and was left hanging there by the receding waters. This was the first intimation of the crew that anything had happened. A Russian vessel lying in the harbor was thrown into the street. Other vessels foundered. Railway lines were swallowed up. The square known as the Campo Santo collapsed and sank.

Pulco, a chemist of Messina, had the following experience. He had risen early and was crossing the strait from Messina to Reggio at 5.30 o'clock on Monday morning. The boat had reached the middle of the strait when he suddenly became aware, as he stood on the deck, that the sea was greatly agitated. The next moment a great chasm opened in the water, and the boat dropped seemingly forty or fifty feet. Pulco believes that it touched bottom. Then it was picked up by a huge wave and hurled high up on a mountain of water, only to descend into the trough again, where it again appeared to strike the bottom.

Most of the people on board were swept off and drowned. The boat was badly wrecked, but it floated ashore. Pulco was still on board.

CHAPTER VII.

The Harvest of the Fire Demon and the Ghoulish Robbers of the Victims.

FOLLOWING the earthquake shock in Messina, as in the case of the overthrow of San Francisco, a few years before, fire broke out in all quarters and threatened to finish the work of ruin which the earthquake had begun. Though the sea rushed on shore in a fierce tidal wave and torrential rains deluged the streets, the flames made their way in many places, with the dire effect that numbers of those buried beneath the ruins died a terrible death from the devouring flames.

With the water pipes destroyed, no effort could be made to stay the fire, while from the gas pipes rent by the upheaval, new centres of conflagration began, adding scores of small fires to the general destruction. The soldiers bent every effort to check the sweep of the flames, but, handicapped as they were by the lack of water, and by explosions of gas, the extinguishing of the fire proved a difficult task, and several days passed before it was accomplished. Sailors from the warships in the harbor lent their aid in this work, but the fires continued to burn in some quarters till there was nothing combustible left to consume. The torrential rains helped in this task and prevented the conflagration being as destructive as it might otherwise have proved.

As the Ebro, one of the rescuing vessels, steamed through the

Straits, many scenes of horror and anguish could be seen from her deck. As the darkness settled down upon Messina the conflagration that was fast destroying what remained of the doomed city was luridly visible, and only a skeleton of a house here and there could been seen upright in the gloom.

As the Ebro moved onward it was seen that many once lively villages on the neighboring shores had been completely obliterated, or were nothing more than heaps of shapeless ruins with occasional flames springing up to show where they once had stood.

As in all cases of human suffering, and calamity, the brood of born brigands who usually lie dormant in the lowest depths of the haunts of civilization were quick to take advantage of the situation, broke loose from the restraint of the law and the police powers, and began the career of looting and outrage which invariably takes place in such situations. The latest historical instance of this invariable outbreak of the wild passions of greed and brigandage was in the San Francisco catastrophe. There it was checked as quickly as possible by the stern hand of the powers of order, and a similar series of events marked the terrors of the Messina earthquake.

The prison at Messina collapsed at the first shock. The convicts numbered about 650, many of whom were killed, but the survivors made their escape and joined the vandals who were sacking the city. Such confusion reigned that the robbers met with no resistance. The local chief of police lay dead in the rooms of his office. Everywhere ghoul-like figures flitted in the semi-darkness, risking their lives among the tottering ruins, fiendishly striving to profit by the disaster. They were vandals robbing the dead and dying and acquiring possessions which they had no means of protecting or conveying away.

The robbers pillaged the ruins of shattered buildings, and even stole clothing and valuables from the corpses of the victims. They were not deterred by the flames that broke out in several sections of the city, but took advantage of the light for their vandalism. The night in Messina was one of horror indescribable—fire, robbery, dead and dying on every side, the city in the utmost confusion and the people panic-stricken and under a spell of terror.

Severe measures were at once taken to check this outbreak of vandalism, the police and soldiers being ordered to shoot the looters on sight, but the wild hope for gain led them to defy and resist the authorities, fierce fights, some of them fatal, taking place. Thus it was reported that six Russian sailors had been shot by thieves while trying to prevent their nefarious work. On the other hand a Russian sailor was said to have shot one of the thieves upon whom were found valuables estimated to be worth $27,000.

For two days the bandits had the upper hand, the scum of the populace being in control and dead and dying alike being victims of their merciless depredations. One was shot while trying to tear a ring from the finger of a dying woman and about sixteen others were slain in the midst of their work. They grew so defiant as to engage in a pitched battle with the sailors and custom officers, and only after the arrival of troops did the authorities gain the upper hand. It was necessary to proclaim martial law, as there were no other means of dealing effectively with the pillagers, one of whom was found in possession of $20,000 in bank notes.

THE GHOULS UNDER CONTROL.

Several days passed before the reign of disorder could be checked, it being finally accomplished by the efforts of General

Mazza, in command of the troops sent to preserve order. Here is his story of the work he had to perform:

"What especially preoccupies me is the succession of thefts since the first day of the disaster. Hundreds of native and foreign malefactors have poured into the devastated district searching among the ruins for bodies to despoil or treasure to sack. The dead have been found with fingers cut off to remove rings and with ears torn to remove ear pendants.

"Many signs of robbery have been discovered in half ruined houses which the thieves penetrated during the days of general fright and disorder. The other night a group of peasants who wanted to enter Messina for evident motives of theft fired at three carabineers, wounding one seriously.

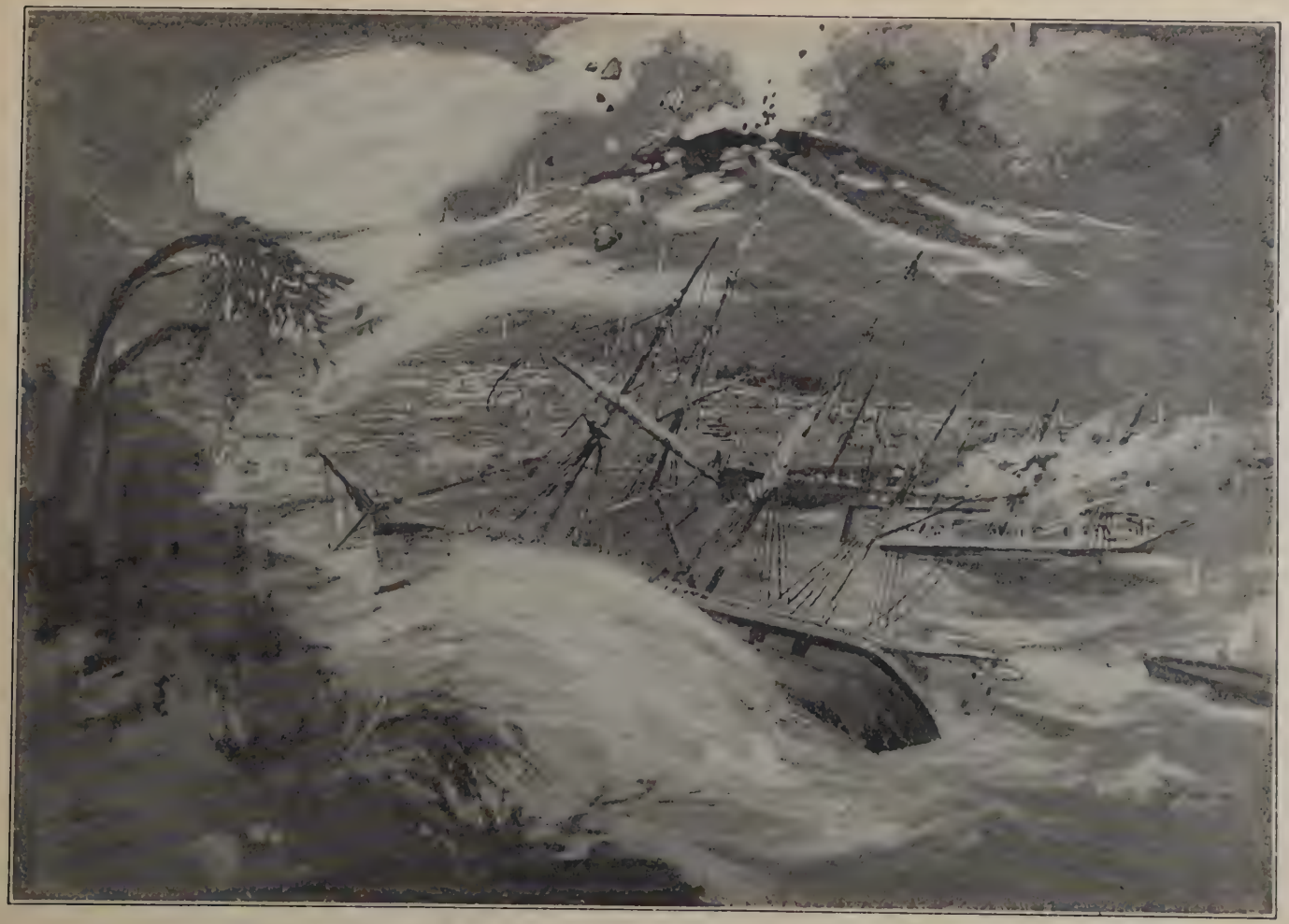
"Every day since the state of siege, which I intend to maintain vigorously, the military tribunals have distributed the gravest penalties to hundreds of persons suspected of theft. All the severity of the military regime will be invoked against those in whose possession are found objects of value or money of which they can give no satisfactory account.

"In order to clear the city of criminals, my programme is to allow no one to enter the city except those whose interests make it absolutely necessary, and to them I shall give an escort of sailors and soldiers to guard against any harm to public or private property. The city will be emptied as much as possible of inhabitants—above all, the vagabonds—who obstruct the work of the authorities. The vagabonds will be ejected, while I will try to persuade the inhabitants to go to nearby villages or to construct huts outside of the town."

Despite all efforts, however, the looters in places continued their

work, defying the bullets of the soldiers in their eagerness for illicit gain, and in some instances not hesitating to murder the helpless survivors for the purpose of theft. And even after the rigid enforcement of martial law in Messina complete anarchy prevailed in the outlying regions, as yet left without police or military guards.

While the fires apparently had been extinguished, they were lying latent under the ruins, and, fanned by a high wind on the night of January 18th, they broke out again on the following day in a furious blaze that assumed formidable proportions before it could be checked. It started near the remains of the City Hall and the Bank of Italy, and during the afternoon spread over a large area, making its way to the shore and threatening the vessels at the docks. The remains of the Pennisi Palace fell in and added to the conflagration, an odor of burning flesh mingling with the smoke and exciting the fear that persons still alive were being consumed. A large section of the quay-side walls fell in during the progress of the fire, the lack of water and the absence of open spaces to check the flames rendering the work of the fire-fighters very difficult. Late in the evening the fire burned itself out, all the inflammable material within its reach being consumed, and probably a large amount of valuable materials buried in the debris being destroyed. The Duke of Genoa had a narrow escape from being buried under a falling wall while assisting in the work. When the flames at length died out an enormous gap had been opened amid the ruins in that part of the city.



Copyright by Wm. E. Scull.

CATANIA OVERWHELMED BY THE EARTHQUAKE AND TIDAL WAVE.
The snow-covered slopes of Mt. Etna are seen in the background, with the fire-breathing cone rising above them.

EMERGENCY RELIEF FOR THE SUFFERING.

As quickly as possible temporary hospitals were erected in the least devasted open places of Reggio and Messina. United States Amabssador Griscom took a leading part in forwarding the necessities of life to the homeless and the injured survivors.

DEATH IN THE FIRE.

Hundreds of bodies of persons who were unable to escape the flames were gathered and buried by the soldiers and marines.

CHASMS IN A STREET.

This photograph, taken at San Francisco after the earthquake of 1906, shows the rending power of the seismic convulsion. The thick asphalt pavement was opened in deep fissures by the first earthquake.

CHAPTER VIII.

The Panic Flight of a Homeless Host.

THE first moment of the fearful earthquake shock was one of stupefaction. It came so utterly without warning, waking thousands violently from profound slumber to a terrifying vision of sudden death, their houses rocking beneath them, ceilings and floors falling, walls being precipitated into the streets, furniture hurled in every direction, numbers of those who were not flung to immediate death screaming in mortal terror or moaning and groaning in pain.

Starving, bleeding from injuries and almost insane from their terrifying experiences, Messina's survivors fled wildly in all directions. The spectacle presented by the ruined seaport was described as terrifying. Tumbling buildings killed and mutilated thousands, while hundreds of the injured imprisoned in the wreckage were abandoned to their fate by the fleeing populace. One of those who escaped said:

"The earth seemed suddenly to drop and then turn violently on its axis. The whole population, who practically were precipitated from the houses rent in twain, were spun around like tops as they ran through the streets. Many fell crushed to death, and others, bewildered, took refuge for breath beside the tottering walls, where they soon met the fate of their companions."

Many of the fugitives were for a while imprisoned in their

ruined homes, the tumbled heaps of refuse making egress impossible. Darkness still lay over all, and, fearing to move lest they should bring down death upon their heads, many waited in trembling terror for the coming of the light of day. Then they made their way out, often with terrifying perils and difficulties, clambering up inclined floors covered with wreckage and over numberless obstructions until the streets were reached. Often they were forced to leave behind them pleading and weeping victims, so deeply buried in the wreckage that it was impossible to aid them. Most of those who escaped were injured, and for the living unfortunates who remained a dreadful death seemed to impend, from the creeping tongues of flames that shot redly upward from a thousand places and threatened to make the whole stricken city their prey.

THE DISTRACTED FUGITIVES.

The streets were a terrible scene. Walls still crumbling down at intervals, people wandering about in distraction, some of them utterly frenzied, thousands of them fleeing in wild terror for the open country, thousands more gathering along the muddy beaches on either side the ruined city seeking food or trying to get away by sea, while many children died from exposure, and madness attacked numbers of the frenzied populace. Wounded, half-naked, famished, in their hunger they were seen to seize dogs, tear them to pieces and ravenously devour the raw flesh.

The search for food, in fact, became a horror as the days went on and only meagre supplies reached the city. A frightful scene occurred at Messina amid the ruins of the custom house. Bands of famished individuals were groping among the debris in the hope of discovering food. The first of the searchers who were successful

were attacked by others with revolvers and knives, and were obliged to defend their finds literally with their lives.

The suffering was intensified by the lack of drinking water. The water system was entirely demolished. These survivors assuaged their thirst by rinsing their mouths with sea water. The wounds of the injured had to be washed with sea water. Grocers' shops were ransacked for mineral water or anything else to drink.

Here is the experience of one observer of the scene of maddened distraction:

"I have witnessed shocking episodes enacted by famished survivors and have myself felt the pangs of hunger. For long hours I had nothing to eat except a few lemon rinds picked up from the mud and have sought desperately for a morsel of bread. On approaching the military authorities I was sent to a place among the ruins where the municipal assessor, surrounded by a howling mob, was distributing tickets for bread and raw meat. A desperate struggle was going on.

"The soldiers had requisitioned a few oxen, horses and asses—lean, wounded and dying animals, which they hurried off to the seashore, slaughtered and cut them up with bayonets. Pieces were distributed among the people, who with difficulty were kept back by the soldiers with their rifles. No sooner was one piece, still warm, received than it was torn to shreds by ten eager mouths, and the people struggled on the ground for any morsels that fell."

REFUSE TO LEAVE THEIR HOMES.

While the exodus of the terror-stricken was going on there were others affected by a different sentiment. They clung distractedly to the sites of their homes, refusing to leave the heaps

of ruins within which they had lived, crying out that their only safety lay in fidelity to the wrecks of their houses. Force was in many cases necessary to get them to the ships in the harbor, which were as rapidly as possible carrying the fugitives to places of safety.

The most distressing feature of the scene was the appalling disorganization of the rescue work in Calabria. While active efforts at succor were made in Messina, the opposite coast was left unaided, and until Friday night not a morsel of food had arrived to relieve those who for four days had been suffering the pangs of hunger. So widespread was the disaster, that it was impossible at first to cover the whole field.

"You who are in authority, tell the Government to take us away from here or have us all shot to end our suffering!" shrieked the famished, wounded, desperate survivors at Reggio, crowding around Deputy Lamagua when he appeared among them.

Every effort was made to do this. Ships crowded the harbors carrying away numbers of the survivors to Naples, to Catania, to Palermo, to every region where help could be hoped for. Naples especially was filled with them, and its hospitals were crowded with the injured.

CAMPS EVERYWHERE.

In the realm of ruin and its vicinity all that was possible was done to care for the refugees. Camps were rigged up everywhere, and scores of children were playing a few steps from the terrible, wrapped-up bundles, containing the bodies of the dead. Wooden huts were put up in avenues and squares for the survivors, some of whom were in disabled cabs, some under mere stretchers of rags.

"A few steps further on might be seen bodies laid at street corners and left unwatched. Then more of such open-air charnel

houses at every turn. Here were dozens of corpses in a row; there fifty, further on perhaps a hundred, and close by the survivors—hundreds around a fire.

At the other end of the town were larger camps. The Piazza della Porta-Bassa was crowded with tents. Mothers nursed their babies by gypsy fires on which rations cooked while the children played about unheeding. All were clad in strange and many-colored odd garments. Rich and poor were mingled and one could not tell who in the crowd might be a rich Sicilian noble or who a poor servant from his abode. Misery made comrades of them all and reduced them to one common level.

We shall conclude this story of the refugees by an extract from a letter written by Mrs. C. F. Powers, an American lady then in Naples:

"What fearful things have happened here! We are in the midst of such suffering and want. We go daily to the Hospital Marie Jesu to wash and comb and feed the poor creatures who are brought here by the hundreds from Messina. All hospitals will soon be full, and most of them are now. The unhurt natives are in the schools, sleeping on straw. This morning we were working over them. The women seemed to have suffered the most and have their hair and ears full of mud and stones and blood. Those who are not badly wounded may have their hair combed and we are sent to do this. This hospital, having an English nurse at its head, is a poor, comfortless place. Among the victims here is one poor woman who had lain one and a half days in a room under the debris with her two boys, one six and the other ten years old, almost dead. She and her husband were saved. She was badly cut and bruised, but remains quiet and uncomplaining."

CHAPTER IX.

A Wonderful Record of Thrilling Escapes.

SHUDDERING under the recollection of what seemed a nightmare rather than actual reality, many of the survivors of the frightful calamity, especially those at Messina, have tried to picture in words of graphic intensity the hour of horror and the succeeding day of terror which followed the catastrophe which overcame them on that dread morn of December 28. They recount the roar of falling structures and the pitiful cries and groans of those pinned beneath the timbers of collapsing buildings. They speak of climbing over dead bodies in their ruined homes and making their way by tortuous avenues through the streets, heaped with the debris of a fallen city. They tell of the caravan of homeless fugitives in their wild flight to the fields and hills for safety, and some of their accounts seem to reach the climax of dramatic presentation of human peril and half-insane terror.

MESSINA AN INFERNO.

A graphic story of the disaster was told by a woman who was brought to the hospital at Catania in a badly wounded condition:

"'Infernal' is the only word that will absolutely describe the fearful and terrifying scene," she said.

"When the first shock came most of the city was fast asleep. I was awakened by the rocking of the house. Windows swayed

and rattled, and crockery and glass crashed to the floor. The next moment I was violently thrown out of my bed to the floor.

"I was half stunned, but knew that the only thing to do was to make my way out of doors. The streets were filled. Everybody had rushed out in their night clothes, heedless of the rain falling in torrents. Terrified shrieks arose from all sides, and we heard heartrending appeals for help from the unfortunates pinned beneath the ruins.

"Walls were tottering all around us, and not one of my party expected to escape alive. My brothers and sisters were with me, and in a frenzy of terror we groped our way through the streets, holding our own against the panic-stricken people, clambering over piles of ruins, until we finally reached a place of comparative safety. But this was not done before I was struck down and badly injured by a piece of furniture that fell out of the upper story of a house.

"All along the road we were jostled by scores of fleeing people, half-clad like ourselves. The houses seemed to be crashing to the ground in whatever direction we turned.

"Suddenly the sea began to pour into the town. It seemed to me that this must mean the end of everything. The oncoming water rolled in in a huge wave, accompanied by a terrifying roar.

"The sky was aglow with the reflection of burning palaces and other buildings, and as if this was not enough, there suddenly shot up into the sky a huge burst of flame, followed by a crash that seemed to shake the whole town. This probably was the gas works blowing up.

"Eventually we reached the principal square of Messina. Here were found 2,000 or 3,000 utterly terrified people assembled. None

of us knew what to do. We waited in an agony of fear. Men and women prayed, groaned and shrieked. I saw one of the big buildings fronting on the square collapse. It seemed to me that scores of persons were buried beneath the ruins. Then I lost consciousness, and I remember no more."

A STEAMSHIP AGENT'S EXPERIENCE.

Achille Carrara, agent of the General Steam Navigation Company in Messina, gives the following account of his experiences:

"Frantic with terror I shouted for my wife, my children and my servants, and assembled them under the arch of the window. The house rocked, but it remained erect. We dressed in darkness and blinding dust, while everything heaved about us. We staggered down the reeling staircase to the street.

"The street was choked with the ruins of the surrounding buildings, and masonry was falling. The injured were shrieking from their tombs beneath the wreckage, and the ground was split up everywhere. Horror was piled on horror, and inky blackness pressed upon us with here and there a flame shooting out from among the wreckage.

"At daylight we found our way to the harbor, where the tidal wave had thrown the water 14 feet above the quay and broken every vessel adrift. The harbor was full of wreckage, casks and capsized skiffs. Four steamers, which had been flung on the quay, had been refloated as the great wave receded, and were hanging by their anchors. They were the Ebro, Drake, Varez and another. We hailed the Drake, and were taken aboard and well attended to.

"Later the captain of the Drake sent a party with me to rescue my relatives, who lived in the north end of Messina.

"The British consulate was found to be a mere dust heap. I located what had been my brother's house, and after digging for hours with our hands succeeded in breaking our way through the fallen masonry, beams, rafters and broken furniture. We rescued my brother, his wife and child and eighteen other persons. We found no trace of my father, mother, grandmother, sister or aunt, and all must have been crushed under the ruins of the three houses."

DR. DENTICE'S STORY.

Dr. Dentice, chief of the governor's cabinet, who lived in the aristocratic quarter of the town, some distance back from the sea, had an interesting story to tell. While his house did not fall, it was severely shaken. He happened to be awake at the moment of the quake, and was flung from his bed before he could get to his feet voluntarily. He called to the others, and all managed to get downstairs, while the shaking continued with ever-increasing violence. They were delayed slightly in leaving by an injury to an old aunt, whom they were obliged to half drag, half carry with them. The last and worst paroxysm was finishing as they reached the street, and to this delay they probably owed their lives, for they escaped the danger from falling masonry. The house was almost at the corner of a small square, and to that they hastened. There they stood in utter darkness for two hours, listening to the death throes of the dying city.

When asked what was the effect upon him and his companions of those two hours of suspense and what they did, he replied:

"We did nothing. We stood silent in the rain—dull, dazed, half-stupefied. I do not remember feeling any keen emotion, not even of fear. I think we all passed into a condition of submissive

indifference. With the slow coming of daylight, our faculties awakened. The gloom revealed little until actual sunrise, and then we strove to make our way to the lower part of the town and the sea front.

"We found, to our astonishment, that we were prisoners. Every street leading from the square was piled twenty feet high with impassable ruins. We imagined that we alone were the victims of this isolation, and we looked for the speedy coming of soldiers or relief parties. We had no suspicion of the truth until two hours later, when I saw a priest a little distance down one street. I shouted to him to know what was the situation elsewhere.

"'Messina is no more!' came back the answer. Even then I failed to comprehend the extent of the disaster, but I began to struggle over the debris toward the shore. I reached it after about an hour, and then I realized that the priest had not exaggerated."

A woman who escaped unhurt from Messina told of her experience.

"We were all sleeping in my house, when we were awakened by an awful trembling which threw us out of our beds. I cried out that it was an earthquake, and called to the others to save themselves, while I quickly pushed a few clothes into a valise. The shocks continued, seeming to grow stronger. The walls cracked, and my bureau split in two and then crashed to the floor, nearly crushing me. My hands trembled so that I could scarcely open the doors.

"To increase the terror a rainstorm, accompanied by hail, swept through the broken windows. Finally, with my brother and sister, I succeeded in gaining the street, but soon lost them in the mad race of terror-stricken people who surged onward uttering cries of pain and distress.

"During this terrible flight balconies, chimneys and tiles showered down upon us continuously. Death ambushed us at every step. Instinctively, I rushed toward the water front, but there found the grand promenade transformed into a muddy, miry lake in which I slipped and often fell."

Another survivor of Messina says:

"I was thrown out of bed. Then the floor of my room collapsed and I fell into the apartment under me. Here I found a distracted woman searching for her sister and son, whom she found dead. We remained in the ruins for twenty-four hours, alone, without food or drink. We made a rough shelter of boards to keep off the rain.

"Our ears were assailed with the cries and moans of the wounded. These sounds abated somewhat during Monday night. Still no one came to our assistance. We were as in a tomb, with the bodies of our children beside us. We could see no one, but every time sounds were heard from the street there would come an outburst of piercing cries for help from the injured and pinioned in the wreckage.

"Tuesday morning we ventured forth and were taken aboard a vessel in the harbor. We passed over streets that were vast crevasses and climbed over great mounds of ruins and wreckage that were all that remained of the finest palaces of Messina."

NARRATIVES FROM CALABRIA.

The Marquis Vincenzo Genoese, a refugee from Palmi, says he was awakened by a tremendous roar. It seemed as though the house was whirling around like the wings of a windmill. The walls of his dwelling cracked and through it came a cloud of suffocating

dust. Stunned, but uninjured, the Marquis tried to escape to the streets, but the stairs had collapsed. He descended from a third-story window by a rope.

Walking was difficult, owing to the fact that the streets were filled with debris. He assisted in dragging from beneath the ruins eighty-six persons, all of them dead. The faces of every one of them showed the agony they had suffered. Many had their arms across their faces, as though to protect themselves from the falling debris. It was necesary to release the prisoners at Palmi, and many of them succeeded in making their escape.

A correspondent of the Paris *Matin,* had a harrowing experience in his journey from Naples to Messina. He said:

"My nerves will never recover from the atrocious impressions to which they were subjected, and my eyes will retain as long as they remain open the vision of death and devastation which oppresses them. A mournful silence covers the country like a funeral pall.

"I proceeded as far as Palmi by train, and thence afoot. Six or seven inhabitants accompanied me to Tropead, and I decided to reach Reggio at whatever cost. Two or three railroad firemen, cut off from home while at duty by the catastrophe, were returning to seek news of the fate of their families. They preceded me, brandishing resinous, smoky torches. We marched in Indian file through the tunnel from Palmi to Bagnara, holding hands and stumbling over ballast heaps. The roof of the tunnel was cracked everywhere, and now and then rocks fell. Whole families were encamped around wood fires and smoking torches. Many of them were wounded. Men, women and children, stupefied by the catastrophe and crouching among the stones, looked at us with vacant glares, as if their thoughts were wandering.

"Some distance along we came upon families roasting sea birds

which had been killed by the tempest and cast upon the beach. Others had the strangest objects packed in sacks. In reply to questions as to what had happened at Messina and Reggio, they made vague and desolate gestures, and continued to gaze at us like stalled oxen. After two hours' march we saw Bagnara, perched on the spur of a mountain overhanging the sea.

"The country house of the Mayor, on the summit of the rock, was half tumbled into the sea, but the Mayor was safe. He was giving orders for the installation of a telegraph wire in a freight car. Every house in the town and surrounding country was in ruins. In one I saw tumbled beds and disordered dining rooms. Seated on the broken wall was a man selling bread at exorbitant prices, amid a chorus of curses and maledictions. Another, demented, was trying to dig into the ruins with his fingers.

"The tunnel beyond Bagnara was impracticable. An enormous portion of the mountain had fallen and obstructed the road. We were forced to walk in the sand, often up to our knees in water. Beyond the tunnel the track was torn and the rails twisted. Huge rocks and dangerous masses came rumbling down momentarily. We decided to climb the mountain and advance across the ravines of brushwood.

"Night fell; the rain was coming down in a deluge. My guides marched more with their brains than their legs. I followed mechanically, though ready to drop. At 11 o'clock we reached Pavazzina, a hamlet of 300 inhabitants. Only seven persons remained and they were shivering under the shelter of a couple of sheets stretched across two olive trees. They asked us pitifully for bread, but we ourselves had not eaten since the start, and we knew not what to answer; so we left them hopeless.

"After eleven hours we had covered only twenty miles, every

step at the cost of the greatest exertions. Our clothes were soaked and the torches had burned out. At Scylla we decided to rest, but rest was impossible. The whole countryside, except to the north, was completely blotted out. Walls were standing, but the interiors had collapsed, carrying down the sleeping occupants."

A REFUGEE'S DRAMATIC STORY.

Giuseppe Cutroneo, a refugee who made his way to New York, told the following dramatic story:

"I was in the cattle business in Messina, and to this fact I owe my life. On the morning of December 28th, I got up at 4.15 o'clock to take a trip into the country to buy steers. All was quiet as I left my home, No. 188 Corso Victor Emmanuel, and walked to the station, about a mile distant.

"The place where I used to buy cattle is called Milazzo. The fare from Messina is sixty cents. I got my ticket and boarded the train. As it happened, the car in which I took seat was the last coach, which stood outside the train shed. Had I taken a forward car I doubtless would have been killed. There were eleven or twelve other men in the car. Some of us were about half asleep, we had got out of bed so early.

"Of a sudden the car shot up in the air, falling with a crash on one side. A deafening roar filled my head. The air became suffocating. My body seemed to grow numb all at once. I don't know how long I lay in a sort of stupor before I realized that there was a hole over me, through which I climbed out.

"The spectacle again stupefied me. I thought the world had come to an end and that I was in purgatory. I could not at first recognize what I saw as Messina. Still the earth trembled and quakes came intermittently, each one toppling over walls that had

been cracked or left standing by the first shock. I looked back at the station. It had collapsed, the trainshed had fallen on the forward part of the train and crushed it almost flat.

"As soon as I realized that I was still alive I thought of my wife and three little children. I rushed back into Messina, although now fires had started in all directions. Here would tower the flame of a broken gas main, roaring and leaping like a gigantic torch. There the wood skeleton of a house blazed like a hundred bonfires in one. The air was full of smoke and dust. It was like a fog that I groped through.

"Yet I could see near the shore a great rift, where the earth had been torn apart. Into it many of the houses had fallen, catching fire as they fell, so that the smoke that rose made the ditch look like an elongated volcano.

"The people running about in the streets acted like lunatics. Some were clambering over the ruins in their night clothes, searching for father or mother, brother or sister. Through cracks the people that still lived cried to those they feared were dead. Other survivors whom I met had wound around them bits of carpet or bed clothes, while others had forgotten all about apparel.

"I found only a heap of bricks, twisted iron and wood splinters, where I used to live. The five stories had tumbled into a heap about fifteen feet high. My home was in a four-room flat on the first floor. It had been buried at the bottom. Without thinking how impossible was the task, I began to dig in the ruins. Down below I could hear moans, and they made me work like a madman.

"I would sometimes think I heard my wife's cry, and I would yell down into some crevice, 'Floria! Floria! Here is your Giuseppe!' and then I would call to my children—to Diego, my six-year-old little boy; to Tony, who was four, and Natalina, the baby.

"I was still digging, when some Russian soldiers came and asked me if I did not want something to eat. Until then I did not know I was hungry; although I had gone twenty-four hours without food. They told me I would go crazy if I stayed around the ruins of my home any longer. The Russians were very kind to all of us. They really did more than the men from the Italian man of war. There were eighty people asleep in that house where I lived, and only one or two besides myself escaped.

"For two days and a night I wandered about Messina until I thought the sights of crime and death would drive me crazy. Ghouls began to prey upon the dead, digging up corpses to rob them. When the soldiers caught these fiends at work they would riddle them with bullets. When I got hungry I went to the Russian sailors, and they fed me. But for the Russians many of us would have died.

"On the evening of December 28th, about 200 of the survivors, including myself, went aboard the Regina Marguarita, which the Government had made use of as a transport. We were carried to Palermo. Some of us were so nearly naked that we hid in the hold of the ship during the voyage. Men wore women's clothes, and many women were dressed as men. One prominent politician of Messina, who had been driven half insane by seeing his father buried alive, walked around clad in a shawl.

"Many were so sick that we feared they would die. I myself became so weak that on reaching Palermo I went to a hospital. On my way I met a well-dressed man who, on learning I wanted to come to America, gave me $38 for my passage."

He had only eighty cents on reaching New York, but those who heard his tale quickly subscribed $25 for his aid.

BRIEF NARRATIVES OF ADVENTURE.

As the Serapin, a German steamer, was leaving Messina with a load of refugees, a man made his way to the dock and called repeatedly for his wife and children. The people on board listened attentively. Then from the vessel came a woman's voice.

"I am here! I am here!"

"Are the children there?"

"Yes, we are all here."

But there was no note of joy from the mother. Her heart was benumbed by the experiences of the night.

When the Serapin docked the refugees were found sitting in isolated groups. Physically they were utterly exhausted, and seemed scarcely conscious of their surroundings.

One old man was carrying a little girl in his arms. The child was covered with blood. "Is that your child?" he was asked. "No," he replied. "Yesterday I found her on the pavement in Messina. No one claimed her, and I could not abandon her. I have had her in my arms ever since." Then the old man became oblivious to everything around him.

There was one girl on board the German steamer, her clothing tattered and torn, who had saved a canary bird. She was a music hall singer. Her pet had clung to her throughout the terrible scenes and perched on her finger the bird was chirping merrily. It was the only happy thing on board that ship.

A soldier named Emilio de Castro related that on Sunday, the day before the disaster, he was taken sick and was sent to the military hospital. Early Monday morning he was awakened by a tremendous roaring sound. He felt himself falling, and he thought he was in the grip of a nightmare. It seemed to him that he had awakened in hell, for the air was filled with terrifying shrieks.

He soon realized, however, what was happening. His bed struck the floor below. It paused a moment, and was again precipitated. He struck the next floor, but this gave way at once, and thus man and bed came down from the fifth floor to the ground. He was not injured.

PARROT SAVED TWO WOMEN.

Here is a story of the work of rescue well worth repeating. On the Sunday after the earthquake a party of rescuers heard a faint cry of "Maria, Maria," coming from deep down in a great pile of rubble. They thought it the voice of a sufferer in delirium and they began to dig. They worked for two hours and finally reached a bird cage containing what had once been a bright-plumed bird, now bedraggled and dust-covered, but still voluble and lively. The diggers were so exasperated that they yanked out the cage and one of them suggested that they wring the worthless creature's neck.

But the removal of the cage uncovered a human hand. The hand moved. They fell to work with greater fervor, and presently they dragged from the dirt two living women. The doctors at the hospital said that both would recover.

The animals of Messina were equal sufferers with its human beings. Starvation was the fate of nearly all of them. A correspondent tells the following pitiful stories:

"I tried to photograph yesterday a small monkey on the top of a four-story wall, whence he could not descend, and the pitiful way in which he chattered to me as I climbed over the rubbish beneath him was almost human.

"As I passed the door of a warehouse to-day, the interior of which had collapsed, I saw two dirty paws sticking out for half an inch through a small crack beneath, and there came from within the

most heartrending wails that a cat's throat could utter. I had chicken and meat in my pocket, and I poked half my lunch under the crack of that door. The thanks I received were more eloquent than any ever given me by human tongue."

ODD FANCIES OF SURVIVORS.

An old woman was released from the wreckage of the Church of San Francisco, who did not realize that she had been buried for a week. She explained that she thought she was entombed in the church after having died a natural death, and that she was living in the hereafter.

Some of the survivors seemed to be quite incapable of helping themselves in even the most elementary manner. The following incident is a good example of this condition. A correspondent met a family consisting of father, mother and five children standing practically naked in a small open square. The rain was coming down in torrents.

"For the love of God, help us to get out of this inferno," said the father of the family. "That is easy enough," was the reply. "Go down to the harbor and you will find boats ready to take you away."

"How can we get there?" was the next question. "On your two legs," was answered.

But the family refused to move, the father explaining that they had no umbrellas. It did not occur to him that in their soaked and almost naked condition they might safely dispense with umbrellas.

Here is another story of odd notions told by an observer:

"A short time after I came upon Signorina Tina Marina, a well-known opera singer. She was as distracted as the other persons we had met. In her hand she carried a strange appearing

cage, which upon investigation I found contained a number of live canaries. Although they were chirping and hopping about inside the covering, she persisted in telling me that all were dead. And she would not discuss any other subject."

One dispatch supplies a touch of humor which almost shocks by contrast to the tale of woe. The Marquis Semmola was imprisoned in a Messina cellar which was stocked with provisions. The rescue party which was trying to extricate him was bidden to devote their efforts to saving his children.

"Don't think of me," called out the Marquis, "I am in a bar with plenty to eat and drink."

Paolo Riza, Mayor of Capriolo, was in Messina on a pleasure trip that fateful morning. The floor of his room fell, and half conscious he was precipitated into a mass of rubbish. His body lodged in a niche in a wall, and he was pinioned by a heavy beam, his face being covered by a carpet that threatened to suffocate him. He managed to move the carpet with his teeth until he made an opening in the folds through which he could breathe.

The man lay in this position for five hours, expecting death at any moment. Had it been possible, he says, he would have committed suicide. Once hope sprang up in his breast. A man passed by and the Mayor called to him.

"What do you want?" asked the newcomer.

"What do I want?" repeated the Mayor. "Isn't it clear? Help me out; get me out of here."

Just at this moment another shock came and the man ran away, leaving the Mayor again alone. Finally the proprietor of the hotel where the Mayor had been stopping came and effected his release.

CHAPTER X.

Italy's King and Queen Hasten to the Scene of Desolation.

NO sooner had the news of the disaster at Messina reached Rome and come to the ears of King Victor Emmanuel, than, in consonance with his record in preceding national calamities, he decided to proceed at once to Calabria and Sicily and do all in his power to further the work of rescue, ordering a special train to be made ready to take him as near as possible to the scene of the disaster. From this point he designed to make use of any available means of transport capable of conveying him to Messina and Reggio.

He was not to go alone, however. Queen Helena, on hearing of his decision, resolved to accompany him, saying that she would not give up her privilege of sharing all her husband's dangers. In consequence, the King and Queen left Rome together on their errand of mercy shortly after one o'clock of the 29th of December. A number of Ministers, Senators and Deputies, together with the Mayor of Rome, were at the station to bid them farewell.

Ambassador Griscom was the only diplomat to learn of the departure of the King and Queen from Rome. He hurried to the railroad station and offered his Majesty condolences in the name of the United States, saying that the San Francisco disaster made it possible for America to appreciate the calamity that had overtaken southern Italy. The King and Queen thanked Mr. Griscom warmly

and asked him to convey their appreciation to the American Government and people.

There was a great crowd at the station to see their Majesties go. The women cried and said: "God bless you!" as they bade farewell to their sovereigns.

Among the persons present were a number of Deputies, one of whom, desiring to say something effective, remarked: "The presence of your Majesty will suffice to control the stricken population." Turning sharply upon the speaker, the King abruptly replied: "Don't talk nonsense."

Proceeding by train to Naples, they embarked on the battleship Victoria Emmanuale, reaching Messina early on the 30th. They at once disembarked and made their way into the ruined city.

THE KING AND QUEEN AID THE RESCUERS.

People wept from emotion when they saw the King and Queen of Italy come ashore. The women threw kisses to her Majesty and both were practically carried up the pier in the arms of their subjects. Crowds of the terror-stricken victims swarmed around the royal party, prostrating themselves in the mud and crying aloud for pity. This reception overcame her Majesty, who almost fainted.

The presence of the King acted as a general inspiration. Even the wounded found fresh strength when they learned that his Majesty had arrived among them. An aged man who had been abandoned under a beam that apparently had crushed out his life revived for a moment at the shouts of greeting to the royal pair. He stretched out his hand and raised his head long enough to call out: "Now I can die happy. Long life to the King!" He then fell back and expired.

Many terrible stories were told to the King in connection with the work of rescue. The recuers had to contend with the deep-rooted superstition in the Sicilian mind. In many cases injured men and women clung to the crumbling walls, refusing to let go their hold and seek a safer position.

His Majesty, however, lost little time in listening to a recital of difficulties. He immediately joined a rescue party and labored as unremittingly as the others. His first act was personally to extricate several injured persons pinned in the ruins.

The Queen quickly recovered from her faintness, caused by the distressing sights on all sides, and followed the example of her husband. She devoted her attention principally to the little children and rescued with her own hands a little boy three years old bleeding from many cuts and wounds, and carried him to the dock, where she handed him over to members of the hospital corps.

This work was not without its perils, the King, while standing in one of the streets, running great risk of being buried under the falling walls of a wrecked building. After his work of inspection in Messina, he visited all the wrecked villages along the Sicilian coast, meeting everywhere the same scenes of desolation.

He sought Calabria on the 31st, proposing to make a similar inspection of the wrecked towns and villages in that province. Reggio was reached in the early morning, and in company with the Queen he visited the scenes of wreck and gave directions regarding the work of rescue. Then, re-embarking on a warship, he sent the following wireless message to Premier Giolitti:

"I return from Reggio, which I found in a condition no less disastrous than that at Messina. The Prefect of Reggio says that grave injury has been done to the communes of his province. A

Russian warship with 500 wounded on board will arrive at Naples this morning, and everything must be prepared for their landing and housing. Another Russian ship will carry wounded to Syracuse. It is desirable to provide at Naples a Russian ship with an abundance of medical supplies."

On Friday, New Year's Day, the King took the decisive action of removing from office the mayor and chief engineer of Messina, charging them with supineness and failure to do their duty in the work of rescue of the unfortunates buried in the ruins.

He continued his own labors in both the ruined cities, and Queen Helena, despite his entreaties, refused to return to Rome, saying that her post of duty at that dire time was among the sufferers.

The presence of the King gave a great impetus to the relief work. At Reggio he walked for hours amid the wreckage, apparently taking no thought of food or fatigue in his devotion to the needs of his subjects. Frequently he lent his hands to the work of rescuing some unfortunate victim.

In one case he discovered a man pinned under the ruins. Only his head and shoulders were visible. His Majesty summoned a rescue party and while the men were at work he encouraged the victim.

"Sire," moaned the man, "I can wait for deliverance, but in God's name give me food and drink."

Meeting a group of photographers engaged in taking pictures of the sad scenes, the King chided them for their occupation.

"You had much better turn your efforts to succoring the afflicted," said he.

Both Helena the Queen, and Helena the Duchess of Aosta, were

born on foreign soil, but the people of Italy could not but worship them for their love and devotion, and the unselfish service to the stricken sufferers given by these two women of high lineage has made them doubly dear to all Italians. This devotion was particularly strengthened by the Duchess conveying in her motor car many unfortunate little children from the bare hospitals to her royal palace at Capodimonte.

The Queen looked far from well. She was exhausted, and the terrible scenes she had witnessed affected her strongly. She wept frequently, and on more than one occasion she covered the hands of some unfortunate woman with her tears. With her own hands she bound up their wounds, using her handkerchiefs when other bandages were lacking. She also gave of her worldly possessions, including the rings from her fingers, for their aid and relief.

THE QUEEN HURT IN HER WORK.

While engaged in one of the improvised hospitals, Queen Helena was hurt as a result of the wild outcry of a crazy man, who rushed in screaming: "The end of the world has come. The earth has fallen in. Save yourselves! Save yourselves!"

A wounded woman, to whom the Queen was attending, sprang in terror from her bed and started to run to the door. The Queen, with great presence of mind, placed herself in front and extended her arms to stop her. But the woman was out of her mind with fright. She lowered her head and precipitated herself on the Queen, driving her head with full force against her Majesty's breast. The Queen fell backward. Her mouth became full of blood and this bleeding continued for some time. Yet the next day she continued

her work as usual, although every now and then her lips were reddened with blood.

On the 3d the King and Queen returned to Rome, but their work was not given up, a portion of the Quirinal palace being converted into a workshop in which a number of women were kept busy, under the superintendence of Helena herself, in making clothing for the refugees, while the two little princesses, six and seven years old, were given a corner in which they occupied themselves in making dolls' clothes for the poor little Calabrian children. The promise was made them that, if they did this well, they would be promoted to the work of making baby clothes, a promise that filled to the brim their cup of pride. The King took his share by placing two of the royal palaces at the disposition of those engaged in succoring the victims. The quick and warm response of the two royal persons to the needs of the suffering did much to endear them to their subjects, Sicilian and Italian as well.

CHAPTER XI.

The Buried Thousands and the Noble Band of Rescuers.

DAY had barely dawned upon ruined Messina, on the fatal Monday morning of December 28th, when the hands of rescuers were at work in the desolate streets. Only a miserable fragment of the populace had escaped from their fallen homes. Of the remainder uncounted thousands lay dead in the ruins. But thousands besides were buried alive in the fallen wreck, some of them visible, others made known only by their call for help or moans of pain, and to save the latter from their living death became a duty of immediate and pressing importance.

Many ships lay in the harbor, and from these, when their crews had recovered from the terrifying effects of the tidal wave that had lifted and flung the vessels about like corks, the warm-hearted sailors landed and lost no time in beginning the noble work of rescue.

British, French and Russian warships which were near at hand were rushed to the harbor and their sailors and marines sent ashore, where they at once began the perilous work of removing the wounded from the tottering ruins and conveying them to places of safety. A large number of the rescued were transferred to these and to the Italian warships, which became great floating hospitals, doctors and druggists being hurried to the scene.

The British sailors began their work by saving a family of five

who were imprisoned in a boarding house. They aided in extracting many more who were pinioned beneath the mass of wreckage. The crews of the Russian ships Bogatyr and Slava were equally prompt and efficient, and showed such courage and daring in their work among the unsafe ruins as to win the highest commendation, their praises being on every lip. They hesitated before no danger, digging under tottering walls or entering the unsafest shells when asked to do so by some frantic woman who had not lost all hope that husband or child was still alive.

THRILLING INCIDENTS.

The intrepidity of these heroes from the North led them to dare the greatest risks, as the following story shows:

The incident happened the day following the great quake. A party of Russian sailors found in the center of the town the rear wall of a four-story house still standing precariously. A foot or two of the third and fourth floors remained and upon these narrow ledges were clinging two women and three children crying for help. There were no ladders and rescue seemed impossible. The brave bluejackets did a heroic thing. While one stood on another's shoulder against the outside of the wall, a third carrying a pick, climbed over them, and using his implement as an ice pick, drove it into the mortar high above his head. By this means he pulled himself up to a window sill, released his pick, used it again in the same way to gain a nearer window above, and finally reached the terror-stricken refugees high in the air. He lowered them with a rope to his comrades and then slid down himself. The little party assembled in the narrow courtyard, prepared to depart, and one of the sailors was wrapping his jacket around one of the almost naked children. At that moment the tottering wall fell upon them and killed every one, alike the victims so perilously saved and the brave rescuers.

The work of rescue at the home of the British chaplain, Hulatt, was most pathetic. The rescue party, through heroic efforts, had succeeded on Saturday in reaching a portion of the ruins from under which came groans, indicating that one or more of the inmates of what had been a house were yet living. This fact infused fresh vigor into the men, and they worked heroically; but although they continued in their efforts until late into the night no success rewarded their efforts.

Work was resumed at daybreak Sunday, when the men fell to their task with a vim, feeling certain that Hulatt, his wife and four children were alive beneath the debris. Only a voice was heard now; and that seemingly in amentation. Still the rescuers, among whom were a number of sailors, persevered. Evening fell, and at 8.14 there was another distinct shock of earthquake, which rendered the situation to those who were endeavoring to give succor extremely dangerous, as the tottering walls about them threatened momentarily to collapse and bury them with the victims already there.

The sailors, however, forgetful of the danger, continued their task, refusing to be denied the chance of rescue, and their persistence was soon rewarded, for they found the bodies of Hulatt and one child lying in bed, both dead. The bodies were badly crushed and it seemed as though death had been instantaneous. Undeterred by this gruesome find, the men kept hard at work until finally the groans beneath the twisted ruins ceased and they were convinced that the entire family had perished. Only then the men quit work.

"IS ANY ONE THERE?"

Everywhere rescue parties of soldiers, sailors, and firemen kept unflaggingly at work, their incessant cry, "Is any one there." being heard on every side as they searched diligently among the ruins.

A voice, a groan even, in response would set them vigorously at work. All those lifted from the wreckage were covered with a mantle of white dust that made them look like living images in plaster. So thick was it, that hundreds were probably smothered beneath its choking weight.

Under some wreckage inclosed in a kind of little cubbyhole and protected by two heavy beams two little babes were discovered, safe and uninjured. They were as comfortable as possible, laughing and playing with the buttons on their clothes. No trace could be found of their parents, who undoubtedy lost their lives.

Several children who were taken from the ruins in the first day when hunger was not so pressing, cried and kicked until favorite dolls or toys were found, and one youngster was found still clasping a Teddy bear in his arms.

A sailor who went ashore at Reggio relates that during his work of rescue he was attracted by a sound of infant voices. Looking under a fallen beam he found twins about a year old in a basket. They were uninjured and their clothing was of the best. They have not yet been claimed.

On the Russian warship Tsarevitch, which took many refugees to Naples, three babies were born. The Russian officers drank the health of each newcomer in champagne. A Russian sailor offered to adopt one of the infants, but the mother would not part with it.

SAD FATE OF CONSUL CHENEY.

Of the Americans in Sicily, fortunately all escaped death but two, these being United States Consul Arthur S, Cheney and his wife, who were buried in the ruins of the American consulate. Their fate was first discovered by the Vice-Consul Stuart K. Lupton,

who escaped from the Hotel Vittoria, wearing only his trousers and carrying his shoes and overcoat in his hands. On his way he met a man and woman, both quite naked, and laid the overcoat over the woman's shoulders. Reaching the Consular building, he found that it had entirely collapsed. Over its ruins he climbed, calling out "Cheney! Cheney!" but received no reply.

He continued feverishly to climb over the ruins, hoping against hope, until convinced against his will that the Cheneys had perished, and were buried beyond reach, a neighboring building having collapsed upon the ruins of the Consulate.

Nothing remained to be done but the pitiful work of excavating the ruins and recovering their bodies, and a force of sixty soldiers were put at work on this task, which proved difficult and dangerous. On January 15th, the American battleship Illinois reached Messina from the fleet at Suez and a number of sailors were at once sent ashore to aid the excavating force.

During the afternoon they succeeded in uncovering what had been the bedroom of the Cheneys and in taking out the bodies, which had lain there for eighteen days. There was every reason to believe that death had overtaken them while asleep.

The bodies were at once prepared for shipment and taken on board the American supplyship Culgoa to be conveyed to Naples. The caskets containing them were sealed and each was wrapped in an American flag, American sailors carrying them reverently to the water front, while Italian soldiers and sailors saluted and the people stood by with lifted hats and saddened faces. Arrangements were quickly made for their conveyance with due honor to the United States, as the sad contribution of this nation to the dire roll of dead at Messina.

CHAPTER XII.

World-Wide Sympathy and the Universal Brotherhood of Man.

THE heart of man beats responsive throughout the world and sympathy for one another in misfortune extends to the ends of the earth. Let the occasion arise and the reply is prompt and heartfelt. This is especially the case in our days, when the means of communication between the nations of all regions and climes are so prompt that we learn of disasters in the Antipodes almost at the moment of their occurrence, and have them detailed to us in such vivid reality that we seem almost to be gazing at them as they occur. And our hearts beat with desire to help our brothers of whatever race or color, for in these days the universal brotherhood of man is almost a thing accomplished, so closely linked are all the people of the world by bonds of immediate association.

A very recent example of this was in the case of the destructive earthquake and fire at San Francisco in 1906, when the people of the whole United States stood half paralyzed in startled sympathy, feeling toward the sufferers as though they were brothers in blood, and pouring out of their wealth in unstinted profusion for the relief of the sufferers.

These, no doubt, were sons of our own land, linked to us by the ties of nationality, but in the case of the frightful volcanic eruption of Mount Pelee, a few years earlier, and the destruction of

St. Pierre with all its inhabitants, the sentiment felt for the victims of this disaster was none the less intense and the haste to aid them none the less immediate. The same brotherly feeling was manifested in that other recent disaster, when the city of Kingston, Jamaica, was overwhelmed by a seismic cataclysm and the sympathy and aid of the world were called for. As might be expected from these examples, the terrible disaster in Sicily and Italy, in the closing days of 1908, awakened a like heartfelt response.

The heart of the whole world was touched by the dire disaster and the sufferings of the victims, and expressions of sympathy and offers of aid came from all the nations of Europe and of those in America from Canada to Rio Janeiro, and other capitals of the far South. From the rulers came expressions of condolence and from their subjects spontaneous contributions of that aid which brings the world closer together in times of great calamity. A hundred ships and trains, bearing supplies, were quickly on the way to the desolated region, and all the Ambassadors and Ministers in Rome hastened to express their deep sympathy with Italy in her affliction.

CONDOLENCE AND RELIEF.

Among the earliest and promptest to offer condolence and aid was the United States, which entered upon the work with a spontaneous activity that promised the best results. The first expression of sympathy came in the following cablegram from President Roosevelt to the Italian King:

"His Majesty Victorio Emmanuele, Rome:

"With all my countrymen, I am appalled by the dreadful calamity which has befallen your country. I offer my sincerest sympathy.

The American National Red Cross has issued an appeal for contributions for the sufferers and notified me that it will immediately communicate with the Italian Red Cross.

"THEODORE ROOSEVELT."

The appeal for contributions here mentioned was quickly and abundantly responded to throughout our country, as similar appeals were being responded to in all the countries of Europe.

Stricken Italy had brought the nations of the world together in a common cause as never before in history. From every quarter of civilization relief funds and supplies poured into the country desolated by the earthquake, a work marked by a magnitude and displaying a unanimity without parallel in all the centuries that have gone before.

Coming at a time of profound and universal peace, and yet a time when the various powers were vieing with each other in demonstrations of their martial power and greatness, the piteous disaster seemed to have suddenly changed the whole rivalry of arms to rivalry of mercy instead. All in all, the Italian disaster became a greater force towards the accomplishment of peace and brotherhood among the nations than the most promising of the conferences at the Hague.

THE CELTIC OFF FOR MESSINA.

The first material response from this country came on December 31st, when the naval supply ship Celtic, laden with 1,500,000 rations for the supply of the fleet then nearing Suez, sailed for Messina under orders from the Navy Department at Washington. Admiral Sperry, in command of the fleet, had wired from the Red Sea that

"the men could wait until after the starving and homeless people of Italy were cared for," and in response to his generous request the loading of the Celtic was rushed through, and at 3 P. M., she set sail from New York on her errand of mercy.

"We will have enough food," said Captain Huse, "to feed 30,000 people for 100 days. Aboard are 1,500,000 full army rations, which can easily be made into 3,000,000 ordinary rations.

"The lumber and tents are to provide shelter for the homeless. Shacks and canvas can be furnished for 50,000 people. Some of the tents are those of the hospital service, each one of which can shelter a score or more. The Celtic makes about two hundred and fifty miles a day, and as the distance to Messina is about 3,200 miles, we ought to make the trip in thirteen days."

In Rome Ambassador Griscom was equally prompt and ardent. He chartered for two weeks an Austrian steamer of 8,000 tons, loaded it with medical supplies and provisions, put on it three doctors and fifty nurses, and despatched it without delay to the land of need. For the $60,000 cost, he looked for reimbursement to the generous American people.

This work of international sympathy was received with expressions of warm feeling from the King and the Premier of Italy, the later saying:

"What the United States has done on this occasion is magnificent, and shall not be forgotten. The United States stands first, out-distancing all others in sympathy and generosity. Our gratitude is so great that we cannot find words in which to express it fittingly."

All this was but preliminary. On January 4th, the United States Congress spoke for the whole American people in voting the

splendid sum of $800,000 for relief work in Italy, in response to the following message from President Roosevelt:

"The appalling calamity which has befallen the people of Italy is followed by distress and suffering throughout a wide region among many thousands who have escaped with life, but whose shelter and food and means of living are destroyed. The ordinary machinery for supplying the wants of civilized communities is paralyzed, and an exceptional emergency exists which demands that the obligations of humanity shall regard no limit of national lines.

"The immense debt of civilization to Italy; the warm and steadfast friendship between that country and our own; the affection for their native land felt by great numbers of good American citizens who are immigrants from Italy; the abundance with which God has blessed us in our safety; all these should prompt us to immediate and effective relief."

Of this sum, $300,000 was to reimburse the Navy Department for the cost of the supplies on the Celtic, already despatched, and the Culgoa, which was loading up with supplies at Port Said, preliminary to starting on the same errand of mercy.

THE PEOPLE'S AID.

While the Government thus sprang actively to the aid of stricken Italy, the people of our country were similarly engaged. Crowds were eager to contribute, the New York fund growing until it neared half a million dollars, and other cities adding their quota until the total surpassed a million. The Canadian government contributed $100,000, and every civilized nation of Europe and America added generously to the sum total.

CHAPTER XIII.

The Red Cross Society, the Lighthouse of International Charity, Sends Its Beneficent Aid.

THE tidings of the disaster in Sicily had barely reached the nations of the civilized world before the Red Cross Society, that international realm of sympathy and charity, was actively astir in its work of beneficent aid, bringing all its energies and the opportunities of its organization to bear on the collection and despatch of funds for the benefit of the earthquake victims. Money flowed with remarkable freedom into its coffers, and flowed out of them as freely for the amelioration of the sufferers from the catastrophe.

Not only in the United States, but in many other lands, was this activity manifested, the International Red Cross Society being an informal union between the Red Cross Societies of the several nations to work in unison for the relief of the afflicted in every land and clime. It is so organized as to make its labors wonderfully effective. Every dollar sent, for instance, by the Red Cross of America to the Red Cross of Italy, goes by cable order, and is put to work at once, the cable order serving the purpose of the money itself. Thus almost on the eve of the day of the disaster $50,000 were telegraphed under the ocean to Italy, and the cash was there immediately forthcoming for the purchase of supplies.

Shall we speak here of the organization of this help-giving

society, in which the best instincts of the age are embodied? A brief statement of it will surely be of interest. It originated in the several societies previously in existence for the care of the sick and wounded in time of war. These had adopted the Red Cross as their badge and emblem, and were first brought together as an international association at Geneva, in 1863. Other conferences have since been held, but the International Committee at Geneva still persists, as a central body to facilitate the action of the different national societies.

The Red Cross Society in the United States was organized by Miss Clara Barton in 1881, and at once joined the International Union. It was due to Miss Barton that disasters of all kinds, such as those of flood, famine, pestilence, etc., were added to war in the scope of such associations. This broader idea, applied by her to the American Society, was immediately adopted by the societies abroad, and incorporated among their duties under the name of the "American Amendment." As a result, the American National Red Cross Society has collected and distributed large sums for the relief of suffering in such cases of calamity as the Johnstown flood, the Russian famine, the Galveston tidal wave, the Mississippi overflows, the Mount Pelee and San Francisco disasters, and on other occasions of urgent need of assistance.

The American Society was definitely organized, under a charter granted by Congress, in 1900, and in 1904 was incorporated under a second act of Congress, Mr. Taft, then Secretary of War, being chosen for its president. But it still lacked completeness of organization for effective work, the collection and expenditure of money being left to local groups, as a rule untrained in such work and unprepared for ready and effective aid in a sudden contingency.

To obviate this weakness in its make up, two new features were added at its meeting in December, 1908. The new office of National Director was created, its incumbent to be the executive officer of the Central Committee, to give his entire time to the work, and to represent the Red Cross in the distribution of money or supplies, in any case of need. To aid him in this work a new class of members of the Society was instituted, these to be called Institutional Members, and to be drawn from the great charitable organizations of the country. Thus a trained director would be aided by trained assistants, and by the aid of such officials its effectiveness would be greatly increased, alike in the collection and distribution of funds and the other demands upon its activity.

It was divided into three departments, those of War Relief, Emergency Relief, and International Relief, each under the care of a special board. As thus organized, it rose at once to the position of one of the most prominent institutions of the country. Mr. Taft consenting to be re-elected as its President, it thus has the President of the United States at its head. Mr. Ernest P. Buckness, for eleven years General Superintendent of the Chicago Bureau of Charities, accepted the position of National Director, and on its War Relief Board are officers of the Army and Navy; on its Emergency Relief Board, men and women of wide experience in relief work; and on its International Relief Board, officers of the United States Department of State.

This statement of the new and effective organization of the American Red Cross Society is of immediate interest in view of the fact that its services were urgently called for within two weeks from the time its improved constitution was adopted. Occupied at the time in the war against tuberculosis, for which funds were being

collected by the sale of the Christmas Red Cross Stamps, a sudden and immense test of its improved powers was made a few days later, when the tidings of the dire disaster in Sicily and Calabria came on the wires under the ocean waves and stirred the heart of Americans to that labor of charity to which it is ever ready to respond.

The branches of the Society both here and abroad lost not an instant, leaping into the breach with the alertness and effectiveness for which they have long been notable.

Thoughout the entire United States there was hardly a city, village or hamlet which did not join, without a day's loss of time, in the work of raising relief funds for the earthquake sufferers. From East, West, North and South came reports of contributions, large and small. By midnight it was estimated that many thousands of dollars had been subscribed to the fund in the United States.

From Germany came tidings that its Red Cross Society had dispatched a special car with hospital supplies for the wounded, and that a second car was being got ready for sending on the following day, the Emperor receiving in farewell audience Dr. Frank Colmers, of the Society, whom the German Aid Committee sent at once to Italy.

From other countries similar news was received and it was widely evident that the energies of the Society everywhere were enlisted in making the prompt response necessary. The first to leave America on similar duty was Edmund Billings, of the Massachusetts Relief Committee, who embarked for Messina for the distribution of the funds raised for the sufferers in that State.

So great was the activity of the American Society that by December 31, three days after the news of the disaster was received, it already had $100,000 ready for use, and much of it had been cabled to the American Embassy at Rome, to be turned over to the Italian

Red Cross Society. Through the latter Society it was decided that all relief for the sufferers should be administered.

By the fourth of January the fund in the hands of the Society had grown to a quarter million of dollars, and this sum Mr. Griscom, the American Ambassador to Italy, delivered to Count Taverna, head of the Italian Red Cross. Count Taverna was overwhelmed and said he would make an exception to the rule which forbids distributing money through any but Red Cross channels, and he returned to the Ambassador $2,000 which he had contributed to the expenses of the relief ship. The Count added that one of the greatest difficulties to be encountered is the prompt distribution of supplies, and therefore outside help was warmly welcomed. On the following day, January the fifth, the subscriptions to the American Red Cross Society had swollen to $400,000, and on the sixth they reached the total of half a million, all of which was cabled without delay for distribution by Count Taverna and the Society which he represented.

Subscriptions continued to come in during the following days, and the beneficent work of the Society continued as long as any evidence of suffering remained. In aid of its labors, the United States Government had prepared and sent to Italy the materials for about 3,000 small houses for the shelter of earthquake sufferers, all red tape being swept aside, so that the vessels containing this material might be sent without delay.

The first vessel to be loaded was the Eva, which sailed about January 22, and had capacity for the materials for about 500 houses. With the lumber were sent nails, putty and glass, so that the houses could be put together with expedition. The remainder was to follow within a few weeks, the whole being sufficient to shelter a small city of fugitives who had been living in tents, where they had any shelter at all.

CHAPTER XIV.

The Summing Up After the Great Catastrophe.

THE tale of the great earthquake as recited in the foregoing page is necessarily brief. It is but a bird's-eye view of one of the most destructive, if, indeed, it is not the most terrible, calamity that nature has visited upon mankind since the days of the flood. The actual loss of life will never be known. The most conservative estimates of the destruction wrought instantly and that which followed immediately after nature's throes of forty seconds, in the doomed cities of Reggio and Messina, and the country adjoining them both in Italy and Sicily, stagger the human mind to comprehend. It is a catastrophe before which civilization stands aghast.

It is said that Italy in this disaster lost more of her children than Russia lost in battle in the whole of her war with Japan—the most deadly combat in modern history. San Francisco's loss of life, in 1906, when earthquake and fire destroyed that splendid metropolis of the West, was insignificant in comparison with this great Italian earthquake which devastated the garden spot of the Mediterrean country during the closing days of 1908. The destruction of ancient Pompeii was hardly one hundredth part as great in the sacrifice of human life as was this modern cataclysm which fills the world with sorrow. It is a picture of tragic pathos before which civilization stands in tearful, and yet in fascinated awe.

As the tidings of the great catastrophe came in, many items of

interest became known, and certain variations in the early tidings were made. At first, for instance, it was reported that radical changes had been made in the depth of the Strait, the harbor channel growing deeper in some places and shallower in others, and that at a point in the Straits where there had been 1500 feet of depth, shallow water prevailed. It was also reported that the shore line had greatly changed. In reverse of this opinion it was later reported that the sea front showed little if any change, and that the geological effects of the convulsion were very slight.

SAVING THE TREASURE.

Mr. Henry R. Chamberlain tells the following story of the saving of the bank treasures:

"I happened to be present about noon to-day at the rescue of the great treasure in the vaults of the Bank of Italy in the Via Garibaldi, and the work had a startling climax. The building was the strongest in Messina, and it had been specially designed to resist earthquake shocks. Against the protests of the engineers, the authorities had insisted upon a deep foundation of concrete. Above this were several layers of alternate iron and concrete, upon which rested the strongroom.

"In this were stored the bulk of all the savings-bank deposits of Sicily, amounting to more than $6,000,000 in gold and cash and securities represnting about $15,000,000 more. The superstructure had been badly damaged, but the strongroom was intact. A group of escaped prisoners tried to loot the place on the day of the earthquake, and several were shot by the police and soldiers.

"Nothing had been touched when the strongroom was opened yesterday for the first time, after several days' work in removing the accumulated debris. The specie was safely removed under

guard and taken aboard a battleship. To-day they got out the safe containing the bulk of the securities. A large force of men, guarded by a double line of 200 soldiers, slowly hoisted the big steel box to the surface. Just after noon they had succeeded with tackle and ropes in dragging it through the entrance into the street.

"As I watched the operation there came suddenly the noise of a terrific explosion as if a 100-ton gun had been fired close at hand. The earth rocked and vibrated, and a moment later the walls of the building, which had withstood the shock of a week ago, fell inward with a great crash and up rose a suffocating cloud of dust. The 200 soldiers dropped their guns and fled in terror.

"The safe with its millions remained deserted for a few moments until the savage execrations of two or three officers brought back the shamefaced troops. Had the shock come ten minutes earlier half a hundred workmen would have been buried in the ruins and there would have been another small tragedy to record."

It need hardly be said in conclusion that the treasure was safely recovered and removed from the stricken city. The funds in another of the banks, amounting to several millions, had already been removed by Russian sailors and taken to Naples, and much other wealth was recovered. All the treasure found was taken aboard the warships. One pocketbook was picked up containing $14,000, and much clothing was found at Messina and elsewhere with bank-notes sewed in it.

Mr. Chamberlain further states: "I have paid little attention to the subject of the pecuniary loss by this disaster. It may amount to $50,000,000—perhaps five times that sum would be nearer the truth. I have not even attempted to count the cities and villages which have been destroyed in this large area. All are architectur-

ally ruined, and they included a population of more than 3,000,000 souls."

There has been much interest in the effect of the Sicilian earthquake and the Messina conflagration upon the foreign insurance companies operating in that section.

All the European companies have strong earthquake clauses in their policies, exempting them from liability for losses caused directly or indirectly by earthquakes.

In spite of this fact the English and German companies have been held, both at San Francisco and Kingston, Jamaica, for earthquake losses, and it is probable similar attempts will be made by the Sicilian policyholders.

The principal Italian stock companies are the Compagnia de Milano and the Fondiaria, of Florence, while the leading mutual is the Reale Mutau, of Turin. The Austrian companies, which have closer relations with Italy, operate generally in that country, the leaders being the Assicurazioni Generali and Ruinione Adriatica di Sicurta, both of Trieste.

The most serious effects upon foreign insurance companies are feared among the life and casualty companies, as the deaths of from 150,000 to 200,000 would naturally mean many heavy claims. While most of these were peasants, hundreds of wealthy merchants in Messina and other large cities were killed, and it is also believed scores of tourists lost their lives, most of whom would carry large insurances.

MR. CHAMBERLAIN ON ITALIAN ARCHITECTURE.

"It is an ineradicable custom of the Italian race to build its habitations, even in the smallest villages, crowded and huddled together, as if space was so valuable that light and air must be sacri-

ficed to it. So-called streets are narrow lanes, giving passage to single vehicles, and without provision for pedestrians.

"This was not true of Messina, yet even there the streets averaged less than forty feet in width; the buildings, including private dwellings, were in solid blocks, with never any space between. Squares and open spaces were rare. Such a construction in an earthquake country is nothing less than a death-trap. To this more than to the violence of the earth's convulsion is due the phenomenal proportion of the casualties.

"San Francisco thought she suffered from an earthquake of the first magnitude. It was child's play, compared with this cataclysm. Messina was shaken as a terrier shakes a rat, until she dropped, bleeding and lifeless, into her own dust. Some say that it was an incredibly violent and swift yanking from side to side, followed by equally rapid upheavals and depressions. Others reverse the process. Some speak of the nauseating effect of the up-and-down motion, but the peril and struggle to escape were too compelling to give way to mere dizziness."

One of the most remarkable things about the Messina earthquake was the length of time that persons lived entombed in the ruins. Had the propositions to burn the place or to cover it with quicklime for the destruction of the decomposing bodies been carried out, a number of persons would have been destroyed who were finally rescued, long after all thought of any one surviving under the wreck had been abandoned. More than once the search was given up as hopeless, to be renewed again when chance led to another rescue. Here is one example in which a dream led to a rescue.

A Sicilian soldier who had escaped from the collapse, dreamed that his fiancee was still alive in the ruins of her home. So vivid was his vision that he obtained permission from his commanding

officer to go with a companion and search. He called her many times and got no response. Then they selected what seemed a favorable spot and began digging. They worked on indefatigably, frequently stopping to shout into the ruins. After about three hours they thought they heard a faint reply.

Frantically they delved into the vast heap, and shortly before noon the dream was realized. The girl lived, just lived, and they dragged her out. Help was summoned, the stretcher bearers came. They gave the poor creature brandy and milk and she revived a little. The transports of her rescuer may be imagined as he walked by her side holding her hand as they carried her to the shore and finally gave her in charge of the nurse of a hospital ship. This humble dreamer of dreams never heard of telepathy. He believes he had a vision from heaven, and who shall deny it?

Even on the nineteenth day after the earthquake a survivor was saved from a living tomb. This was an aged and decrepit woman, unconscious, yet still breathing. But most of those found late were children, who survived the shock better than their elders. A five-year-old boy was found alive and well in the ruins of Reggio two weeks after the disaster. Two girls and a boy lay for eighteen days under a pile of ruins. They had a supply of oil, wine, onions and water that kept them from starvation, and dug themselves so far out that their cries were heard by some passing soldiers. A man who had been caught across the waist by the fall of his house and had watched his wife and children die without being able to help them, was rescued on the fourteenth day.

THE FUTURE OF MESSINA.

What should be the fate of Messina was a question that excited much attention. Should it be left a ruin and its perilous locality

deserted, or should it rise again from its wrecked condition? Signor Orlando, Italian Minister of Justice, insisted that it should be rebuilt.

"You cannot blot out," he said, "twenty centuries of history. The town will be rebuilt as soon as possible. It will be impossible to leave deserted the spot where a city of 150,000 inhabitants flourished, even if 100,000 of the inhabitants perished. The other 50,000 will refuse to abandon their native city forever.

"Loans without interest, spread over a great number of years, will be made to landowners and a judicial commission be at once created whose duties will be to see that the rights of property are respected. I should consider Messina as an existing town even if only three houses remained. I am full of hope you will see Messina rebuilt within two years in accordance with modern ideas and following the example Japan has adopted in districts subject to earthquakes. There will arise, I am sure, another Messina, with at least fifty thousand inhabitants."

The final decision seemed to be , however, that the ruin-covered site should be abandoned and a new town grow up on a new and unencumbered site, a mile distant from the old, thus escaping the great cost and toil of removing the vast heap of ruins. Many of the survivors, however, refused to leave the sites of their homes on any conditions, and as an example of the vitality of the place it may be stated that, in three weeks after the earthquake, lights and water had been restored in Messina, and the shipping of oranges and lemons had been resumed.

THE BEAUTIFUL HARBOR OF DOOMED MESSINA.
Messina is a very ancient city and was at first called Zancle, meaning Sickle, on account of the shape of the arm of land which forms its harbor. The city has passed through war, pillage and previous earthquake, but was never so scourged as in the terrible calamity of 1908, when nearly 100,000 of its 150,000 inhabitants perished.

MADE INSANE BY TERROR.

Terrifying experience, fearful shock and mortal peril rob men's minds of reason. This calamity was added to the miseries of many inhabitants of the ill-fated Italian cities.

THE CATHEDRAL AT MESSINA.
This beautiful piece of architecture was one of the principal buildings in the ruined city.

THE TIDAL WAVE LEAPING UPON MESSINA.
This illustration drawn after the descriptions of witnesses and a photograph of the locality, shows how the sea first withdrew its water from the harbor and then rushed back with terrific velocity, licking up ships, houses and men in its course.

BOOK II.

History and Causes of Earthquakes, Volcanoes and other Seismic Phenomena.

NOTABLE EARTHQUAKES OF WORLD'S HISTORY

A. D.

157—Pontus and Macedonia, Asia, 150 cities and thousands of lives destroyed.
526.—Antioch, earthquake, 250,000 estimated killed.
742—Syria, Palestine and Asia, 500 towns destroyed, loss of life incalculable.
936—Constantinople overturned, all Greece shaken.
1137—Catania, Sicily, destroyed, 15,000 killed.
1268—Cilicia, Asia Minor, 60,000 killed.
1456—December 5, Naples, 40,000 killed.
1531—February 26, Lisbon, 30,000 killed.
1626—July 30, Naples, 70,000 killed.
1667—Schamaki, 80,000 killed.
1692—June 7, Port Royal, Jamaica, 3000 killed.
1693—September, Sicily, 100,000 killed.
1703—February 2, Tokio, Japan, 200,000 killed.
1706—November 3, Abuzzi, Italy, 5000 killed.
1716—Algeria, 20,000 killed.
1726—September 1, Palermo, Italy, 6000 killed.
1731—November 30, Pekin, China, 100,000 killed.
1746—October 28, Lima and Callao, Peru 18,000 killed.
1754—Cairo, Egypt, 40,000 killed.
1755—November 1, Lisbon, 50,000 killed.
1759—October 20, Syria, 20,000 killed.
1773—June 7, Santiago, Guatemala, completely engulfed.
1783—February 5, Messina, 60,000 killed.
1797—February 4, Santa Fe to Panama, 40,000 killed.
1812—March 26, Caracas Venezuela, 12,000 killed.
1822—August 10, Aleppo, Spain, 20,000 killed.
1851—August 14, Melfi, Italy, 14,000 killed.
1852—September 16, Manila, Philippines, partially destroyed.
1855—Tokio nearly destroyed.
1857—December 16, Calabria, Italy, 10,000 killed.
1859—March 22, Quito, Ecuador, 5000 killed.
1860—March 20, Mendoza, S. A., 7000 killed.
1863—July 2, Manila, 1000 killed.
1863—August 15, Peru and Ecuador, 25,000 killed.
1875—May 15, Colombia, South America, 14,000 killed.
1881—April 3, Scio, Italy, 4000 killed.
1883—October 16, Anatolio, Asia, and other towns destroyed.
1885—July 8, Cashmere 70,000 homes demolished.
1886—August 31, Charleston, S. C., 98 killed.
1887—February 24, coast from Corsica to Lyons and Geneva, Switzerland, Italy and France; more than 2000 killed.
1887—May 5, Hawaii, 167 killed.
1888—March, Yun Nan, China, 4000 killed.
1891—Multitudes killed in Japan.
1902—Martinique, 32,500 killed.
1905—Southern Italy, 550 killed.
1906—San Francisco earthquake, estimated 1,500 killed.
1907—Kingston. 800 killed.
1908—Earthquake and tidal wave in Italy.

CHAPTER XV.

Famous Earthquakes of Ancient and Medieval Times.

THE surface of the earth is rarely quite still. Quivers and slight tremors, usually imperceptible to us and discernible only in the delicately adjusted seismic instruments, are of very frequent occurrence, but only in comparatively rare cases do they become strong enough to make their force evident to our senses. It is only in certain limited regions, usually of volcanic character, that an earthquake of sufficient violence to be dangerous is apt to occur, and in some such regions the occurrence of a quake of this kind is sufficiently frequent to keep the inhabitants in a state of nervous uncertainty as to the security of their lives and homes One such locality, dismally famous for its many disasters of this kind, is that surrounding Mount Etna, Vesuvius and Stromboli; while various others exist in the more volcanic regions of the globe.

The earthquakes on record are very numerous, and these are largely those that have occurred during the Christian Era, those of older date being far from fully recorded. Mallet's catalogue covers a list of between 6,000 and 7,000 instances, ranging from 1606 B. C. to 1850 A. D. Several of these are taken from Biblical history, and it is a problematical issue as to what was their actual character. The oldest of these was the shaking of the earth on the occasion of the delivery of the tablets of the law at Mount Sinai, ascribed to

the questionable date of 1606 B. C. A second case was that Arabic convulsion between 1604 and 1586 B. C., when Korah, Dathan, and Abiram were swallowed up, and a third suggested as an explanation of the fall of the walls of Jericho, at a date fixed by him at 1566 B. C.

Another Biblical account, considered by Boscowitz as not only an earthquake, but one of the oldest and most remarkable on record, was that of the destruction of Sodom and Gomorrah, as described in the Pentateuch. According to Boscowitz it was accompanied by a volcanic eruption, upheaved a district of several hundred square leagues, and caused the subsidence of a tract of land not less extensive, the whole water system and the levels of the soil being altered by the destructive outbreak.

The south of Palestine, at the date of this catastrophe, contained the splendid valley of Siddim, dotted with forests and flourishing cities, including Sodom, Gomorrah, Admah, Zoar, and Zeboiim, the sovereigns of which had, just previous to the disaster, joined their forces against the army of the invading king of the Elamites. They had recently fought and lost the decisive battle of the campaign when the dread subterranean forces assailed their cities, hurling them in ruins to the ground and spreading desolation in the flourishing valley in which they stood.

THE BIBLICAL RECORD.

The Biblical record of this disastrous event fixes the date of the catastrophe at sunrise, and gives us reason to understand that the ground opened in a yawning chasm, from which red-hot stones and burning cinders were hurled and fell like a storm of fire upon the land. Here are the words in which the story is told in Genesis:

"The Lord rained upon Sodom and upon Gomorrah brimstone

and fire from the Lord out of heaven; and he overthrew those cities, and all the plain, and all the inhabitants of the cities, and that which grew upon the ground. And Abraham got up early in the morning to the place where he stood before the Lord; and he looked toward Sodom and Gomorrah, and toward all the land of the plain, and behold, and lo, the smoke of the country went up as the smoke of a furnace."

This is such a description of the catastrophe as might be expected from writers who were unfamiliar with such dread occurrences and were apt to attribute unusual events to supernatural causes. The account clearly indicates the nature of the cataclysm, even if one includes the espisode of Lot's wife being turned into a pillar of salt; for this substance frequently occurs in large quantities among volcanic products. In the case in question the ashes hurled forth from the volcanic depths of the earth might have been saturated with salt, for that district at the present day is covered with it, one walking there upon a thick stratum of friable salt which crunches beneath the feet, and extends as far as the eye can reach. If Lot's wife halted in the flight to look back upon the thrilling scene, she might well have been overtaken by the shower of hot, saline ashes. In this case her body would have presented the appearance of a pillar of salt, when this substance had become crystallized upon her after the eruption.

EVIDENCE OF THE DISASTER.

Our knowledge of this disaster is not confined to the Scriptural account, a record of the great catastrophe being preserved still in the traditions and legends of Syria and the writings of ancient historians like Tacitus and Strabo, in which we are told that Lake Asphaltite was formed during the terrific shock and opulent cities

were swallowed up in the abyss or destroyed by fire belched forth from the earth. In the eyes of a religious people, and one unfamilar with such occurrences, it is natural that such an event would be regarded as a visitation from the heavenly powers, a punishment for crime and wickedness; but all we know of it from other sources indicates that it was the result of one of the ordinary convulsions of nature.

Of the valleys watered by the Jordan, that of Siddim was the largest and most populous. On the day of the great disaster there is reason to believe that all the southern part of this valley, with its woods, its fields, its towns and cities, its broad river, was upheaved. On the northern side the plain seems to have sunk, a vast cavern being formed for a distance of a hundred leagues. The waters of the Jordan, suddenly arrested in their flow by the lifting of the soil in their lower channel, were probably at first driven back in an impetuous wave, and then poured forward again as impetuously, to fall into the great abyss opened in their channel.

When, after the catastrophe, men came tremblingly to gaze upon its effects, they found the aspect of the country strangely altered. The valley of Siddim had vanished, a vast sheet of water covering its former location, into this the Jordan flowed, but beyond the great lake this stream, which had of old fertilized the country as far as the Red Sea, had ceased to exist. Lava, ashes and salt covered a country once the home of a busy population, the seat of cultivated fields and active communities.

As the country appeared then, so it appears now. We see there only an expanse of calcined rocks, masses of black lava, blocks of rock salt, rough ravines, sulphurous springs, bituminous marshes, and the vast Lake Asphaltite, now fitly known as the Dead Sea.

This Sea, the depth of which remains unknown, exists as the

fitting result of such a catastrophe. Lying about 690 feet below the level of the ocean, in the vast depression caused by the earthquake, its waters extend over an area of a hundred square leagues to the foot of the salt mountains and basaltic rocks which encircle it. One sees here no trace of vegetable or animal life. Not a sound is heard upon its shores, deeply impregnated with salt and bitumen. The birds avoid even to fly over its dread surface, from which unwholesome effluvia arise; while in its waters, bitter, salt, and oily, no life can exist. No wind can stir the surface of this heavy and silent sea, and nothing moves therein, except the thick load of asphalt which at times rises from its bottom and floats to its desolate strand.

The upper Jordan remains, as in early times, the life-giving artery of Palestine; but its lower waters, which formerly found their way to the distant Gulf of Arabia, are now entombed in this sombre abyss, the most desolate body of water upon the face of the earth.

ANCIENT EARTHQUAKES IN CHINA AND JAPAN.

Evidences of disaster so great as the above are not to be found elsewhere in ancient history or tradition, or in the present aspect of any country, but records of earthquake convulsions are found in the annals of many countries of the past. The earliest from China dates back to 595 B. C., and from Japan to 286 B. C., while the first recorded in India is of the much later date of 894 A. D.

That of Japan must have been a prodigious cataclysm to give warrant to the tradition still extant concerning it. This, which took place in the island of Nippon, in the vicinity of the site of modern Tokyo, must have been volcanic in character, for flames are said to have issued from the earth and a tract of country sixty miles in circumference to have been raised to an enormous height. This was

the volcano of Fusiyama, the holy mountain of Japan, which, as the legend relates, reared its lofty summit in a single night to its present altitude of 12,258 feet. More probably it had its beginning on that night, and has since grown, as volcanoes everywhere grow, from its own outpourings.

At the same time, so the legend states, a depression to match this elevation was taking place elsewhere. At a great distance from the scene of upheaval an immense plain, shut in with lofty mountains, was violently shaken, and suddenly sank downward, with the forests, towns and villages upon its surface. Into the great cavity thus formed the waters poured and a lake arose thirty-five miles in length and ten miles in width. Such is the origin of Lake Biva, as given in Japanese lore. But instead of bearing any resemblance to the Dead Sea, it is a splendid and limpid sheet, the blue waters and beautiful shores of which remind one of the Lake of Geneva.

Though we have given the date of the earliest Chinese earthquake record as 595 B. C., tradition goes back nearly two thousand years beyond that date and tells us of a vast convulsion in the reign of the mythical Yao, whose accession is given at 2357 B. C. We are told that, at that remote period, violent earthquake shocks broke up the eastern shore of a mighty sea that occupied the vast area of the desert of Mongolia, its waters pouring in an overwhelming flood upon Northern China and drowning the whole population.

EARTHQUAKE TRADITIONS OF GREECE.

It is singular that in Greece exists the tradition of a mighty catastrophe which occurred at about the same time as that credited to China, its date being given as about 2400 B. C. This earthquake is said to have spread over a vast tract of country, including Greece, Asia Minor, Thrace, and the beds of the Black and Mediterranean

Seas. At that period an isthmus, according to the tradition, separated the Black Sea from the Sea of Marmora. The shock broke through this isthmus and formed the Strait of Cyanes, now known as the Bosphorus. The two seas poured in fury into the chasm and covered the whole of Greece with their waters, such a deluge being produced that all the inhabitants of Greece and Asia Minor were drowned, with the exception of a few shepherds who dwelt upon the tops of the highest mountains. The recollection of some such catastrophe lived long in the islands of Rhodes and Samothrace and among the Phrygians and Egyptians, though the latter suffered little.

In another tradition of the remote past, that of the famed island of Atlantis, lying in the Atlantic ocean far beyond the pillars of Hercules, we are told that the men of Atlantis attacked Greece, Egypt and other nations and that during the desperate war which followed there came a terrible earthquake, which in one night drowned all the army of the Greeks and at the same time engulfed the great isle of Atlantis, which sank into the ocean which has inherited its name. This legend, told by Egyptian priests of Solon and given to us by Plato, may have had to do with some remote convulsion to which tradition gave this very problematical form.

Coming to a later, but still a very remote date, that of the nineteenth century before Christ, we are told that the whole population of Attica was drowned by the inundation that followed an earthquake. The Greeks called this the deluge of Ogyges, a king of that name then reigning in Attica. At the same period, or as some say three centuries later, there was an earthquake in Thessaly which was followed by the overflow of rivers and an inroad of the sea. This catastrophe drowned all the people except Deucalion, the king,

and his wife Pyrrha, who escaped upon a vessel which, at the end of a week, grounded upon Mount Parnassus. After their escape the king and queen repeopled the country by throwing stones behind them as they journeyed down the mountain, these being transferred into men and women. This story bears an interesting resemblance to that of the Noachian deluge.

Coming down from legendary to historical times, we meet in Greece with the record of a violent earthquake in a night of the year 373 B. C., which extended throughout the whole country, its principal injury being in the Peloponnesus, where, when day dawned, two towns, Bura and Helice, were found to have disappeared. Helice, though several miles inland from the Gulf of Corinth, was engulfed in its waters, and long afterward, when the waters of the gulf were calm, the appearance of a mysterious city might be discovered in their depths. This was the once superb Helice, its houses in ruins, its temples and marble columns in fragments.

Elsewhere we have described the remarkable volcanic eruption of Mount Vesuvius in 79 A. D., by which two cities, Herculaneum and Pompeii, were buried in volcanic ash. While this was the first recorded eruption of the volcano, the region surrounding it has been visited by earthquakes before, one of these, which occurred 63 A. D., having done great damage to these cities and killed many of their inhabitants. It was a little heeded warning of their final fate sixteen years later.

ANTIOCH AND ITS DISASTERS.

In the world's record of earthquakes there is none more destructive than that which wrecked the famous city of Antioch in 526 A. D. This great city, built in 300 B. C. by Seleuces, one of the successors to the divided empire of Alexander the Great, and which ranked after Rome and Alexandria as the third greatest city of the

age, was specially subject to earthquake disasters, which visited it on many occasions.

The first one on record was of the date of 148 B. C., but mythical tradition seems to point back to earlier ones. At least this may be the correct interpretation of the myths of the giants Typhon and Pagres, who were struck there by the thunderbolts of Jupiter. In the early centuries of the Christian era, earthquakes were frequent and severe in that locality. One of these, that of 37 A. D., caused so much damage that the emperor Caligula sent two Roman Senators to Antioch to look into the state of the city. In the reign of Claudius another followed. To act as a preventive to any more, the magician Dabbonius placed a bust on a purple column in the centre of the city, with an inscription appealing to the superstitious among the citizens. But his effort to stay the earthquake proved vain, for the next shock overthrew the column and bust.

The most severe of these early earthquakes was that of 115 A. D. At the time of its occurrence the city was full of Roman soldiers, whom the emperor Trajan was then leading in a campaign against the Parthians. Great destruction to buildings and loss of life succeeded, the rivers changed their courses, Mount Casius shook violently, and the emperor, to escape danger from the falling buildings, was forced to take refuge for several days in the circus.

The greatest of the earthquakes that visited Antioch, and the most destructive to human life of any on record, was that of 526 A. D. The city was entirely destroyed and the loss of life enormous, it being estimated at 250,000 persons. As on the last named occasion the presence of a Roman army added to the loss, so in this instance the presence in the city of an assembly of the Christian Church swelled greatly the sum of the dead.

In naming the other visitations of Antioch, we must speak of

those of 341 and 457 A. D., the latter attended with considerable loss. In November, 528, two years only after its overthrow, the partly restored city was again severely shaken, 5,000 of its citizens falling victims. In 587 A. D., came another shock, followed on the last day of October, 588, by a frightful one, attended by a terrible loss of life. All those disasters, together with others due to war and conflagration, proved fatal to the eminence of the city, which afterward passed under the hands of various masters, the Persians, the Saracens, the Crusaders, the Turks, and finally in 1268, under that of the Sultan of Egypt, who wrecked it so thoroughly that it never revived. To-day it is a small town of a few thousand inhabitants dwelling in hovels of mud and straw. Yet it is still not free from its ancient enemy, who returned in 1822 to shock it into memory of its old-time calamities.

Many other desolating earthquakes of early date might be named, as may well be imagined when we consider the number of severe ones that have occurred within a century. Of these only those of most destructiveness need be named. The Peninsula of Hindostan, while not especially subject to such convulsions, has been the seat of several severe ones, among which that of 893 A. D. almost rivals Antioch in the destruction of human life, the loss being estimated at 180,000. One which occurred in Persia in 1139 is credited with 100,000 victims. Coming to a date nearer our own, we find Lisbon credited in 1531 with a loss of 30,000, a destruction of life approaching that of its great disaster in 1755. In 1693 Sicily was fearfully visited, its death roll being estimated at 93,000. Returning to the East, we find in China and Japan examples in late centuries of enormous sacrifices to the earthquake demon, the 1703 shock in Yeddo, Japan, slaughtering 190,000 of its people, and that of 1731 claiming 95,000 victims in Peking, China.

CHAPTER XVI.

The Great Lisbon and Calabrian Earthquakes.

NUMEROUS thrilling examples of the destructive work of the earthquake at various periods are on record. Of these we shall confine ourselves to a few striking examples of its destructive action. In the record of great earthquakes, one of the most famous is that which in 1755 visited the city of Lisbon, the capital of Portugal, and left that populous place in ruin and dire distress. It may be well to recall the details of this dire event to the memories of our readers.

THE GREAT LISBON EARTHQUAKE

On the night of the 31st of October, 1755, the citizens of the fair city of Lisbon lay down to sleep, in merciful ignorance of what was awaiting them on the morrow. The morning of the 1st of November dawned, and gave no sign of approaching calamity. The sun rose in its brightness, the warmth was genial, the breezes gentle, the sky serene. It was All Saints' Day—a high festival of the Church of Rome. The sacred edifices were thronged with eager crowds, and the ceremonies were in full progress, when the assembled throngs were suddenly startled from their devotions. From the ground beneath came fearful sounds that drowned the peal of the organ and the voices of the choirs. These underground thunders having rolled away, an awful silence ensued. The panic-stricken multitudes were paralyzed with terror. Immediately after the ground began to heave with a long and gentle swell,

producing giddiness and faintness among the people. The tall piles swayed to and fro, like willows in the wind. Shrieks of horror rose from the terrified assembly. Again the earth heaved, and this time with a longer and higher wave. Down came the ponderous arches, the stately columns, the massive walls, the lofty spires, tumbling upon the heads of priests and people. The graven images, the deified wafers, and they who had knelt in adoration

GREAT EARTHQUAKE AT LISBON, NOV. 1, 1753.

before them—the worshipped and the worshippers alike—were in a moment buried under one undistinguishable mass of horrible ruins. Only a few, who were near the doors, escaped to tell the tale.

It fared no better with those who had remained in their dwellings. The terrible earth-wave overthrew the larger number of the private houses in the city, burying their inhabitants under the

crumbling walls. Those who were in the streets more generally escaped, though some there, too, were killed by falling walls.

The sudden overthrow of so many buildings raised vast volumes of fine dust, which filled the atmosphere and obscured the sun, producing a dense gloom. The air was full of doleful sounds —the groans of agony from the wounded and the dying, screams of despair from the horrified survivors, wails of lamentation from the suddenly bereaved, dismal howlings of dogs, and terrified cries of other animals.

In two or three minutes the clouds of dust fell to the ground, and disclosed the scene of desolation which a few seconds had wrought. The ruin, though general, was not universal. A considerable number of houses were left standing—fortunately tenantless—for a third great earth-wave traversed the city, and most of the buildings which had withstood the previous shocks, already severely shaken, were entirely overthrown.

WATER ADDS TO THE DESTRUCTION

The last disaster filled the surviving citizens with the impulse of flight. The more fortunate of them ran in the direction of the open country, and succeeded in saving their lives; but a great multitude rushed down to the harbor, thinking to escape by sea. Here, however, they were met by a new and unexpected peril. The tide, after first retreating for a little, came rolling in with an immense wave, about fifty feet in height, carrying with it ships, barges and boats, and dashing them in dire confusion upon the crowded shore. Overwhelmed by this huge wave, great numbers were, on its retreat, swept into the seething waters and drowned. A vast throng took refuge on a fine new marble quay, but recently completed, which had cost much labor and expense. This the sea-wave

had spared, sweeping harmless by. But, alas! it was only for a moment. The vast structure itself, with the whole of its living burden, sank instantaneously into an awful chasm which opened underneath. The mole and all who were on it, the boats and barges moored to its sides, all of them filled with people, were in a moment ingulfed. Not a single corpse, not a shred of raiment, not a plank nor a splinter floated to the surface, and a hundred fathoms of water covered the spot. To the first great sea-wave several others succeeded, and the bay continued for a long time in a state of tumultuous agitation

About two hours after the first overthrow of the buildings, a new element of destruction came into play. The fires in the ruined houses kindled the timbers and a mighty conflagration, urged by a violent wind, soon raged among the ruins, consuming everything combustible, and completing the wreck of the city. This fire, which lasted four days, was not altogether a misfortune. It consumed the thousands of corpses which would otherwise have tainted the air, adding pestilence to the other misfortunes of the survivors. Yet they were threatened with an enemy not less appalling, for famine stared them in the face. Almost everything eatable within the precincts of the city had been consumed. A set of wretches, morever who had escaped from the ruins of the prisons, prowled among the rubbish of the houses in search of plunder, so that whatever remained in the shape of provisions fell into their hands and was speedily devoured. They also broke into the houses that remained standing, and rifled them of their contents. It is said that many of those who had been only injured by the ruins, and might have escaped by being extricated, were ruthlessly murdered by those merciless villains.

LIFE IN A SICILIAN VILLA GARDEN.

The south of Italy and Sicily, in the locality where the earthquake occurred, is blest with a perfect climate, as if Nature intended to compensate the inhabitants of her wonderland for the calamities with which she has seen fit to afflict them at intervals. The people spend most of their time in the open air and the gardens of their houses are really great outdoor living rooms.

RUINS OF THE ANTIQUE THEATRE AT TAORMINA, SICILY.

The celebrated theatre of Taormina, which overlooks the most beautiful scenery in the world, with the snowy crest of Mt. Etna in the background, is an interesting relic of the ancient importance of this region. The Greek and Roman audiences sat in the open air and the actors played on a stage erected in front of the *proscenium*, the walls of which are shown in these illustrations.

THE BAY OF NAPLES AND MT. VESUVIUS IN DISTANCE.
The beautiful bay of Naples, a portion of which is here shown from the high ground behind the city, is ever menaced by the smouldering activity of Vesuvius, whose seething crater destroyed Pompeii and Herculaneum. It has frequently belched forth destruction on later towns which lie at its foot.

FLEEING THE WRATH OF VESUVIUS.

Thousands of the poor Italian peasants left their homes near the mountains and took shelter in Naples during the eruption of 1906.

The total loss of life by this terrible catastrophe is estimated at 60,000 persons, of whom about 40,000 perished at once, and the remainder died afterwards of the injuries and privations they sustained. Twelve hundred were buried in the ruins of the general hospital, eight hundred in those of the civil prison, and several thousands in those of the convents. The loss of property amounted to many millions sterling.

WIDE-SPREAD DESTRUCTION

Although the earth-wave traversed the whole city, the shock was felt more severely in some quarters than in others. All the older part of the town, called the Moorish quarter, was entirely overthrown ; and of the newer part, about seventy of the principal streets were ruined. Some buildings that withstood the shocks were destroyed by fire. The cathedral, eighteen parish churches, almost all the convents, the halls of the inquisition, the royal residence, and several other fine palaces of the nobility and mansions of the wealthy, the custom-houses, the warehouses filled with merchandise, the public granaries filled with corn, and large timber yards, with their stores of lumber, were either overthrown or burned.

The king and court were not in Lisbon at the time of this great disaster, but were living in the neighborhood at the castle of Belem, which escaped injury. The royal family, however, were so alarmed by the shocks, that they passed the following night in carriages out of doors. None of the officers of state were with them at the time. On the following morning the king hastened to the ruined city, to see what could be done toward restoring order, aiding the wounded, and providing food for the hungry.

The royal family and the members of the court exerted themselves to the uttermost, the ladies devoting themselves to the preparation of lint and bandages, and to nursing the wounded, the sick,

and the dying, of whom the numbers were overwhelming. Among the sufferers were men of quality and once opulent citizens, who had been reduced in a moment to absolute penury. The kitchens of the royal palace, which fortunately remained standing, were used for the purpose of preparing food for the starving multitudes. It is said that during the first two or three days a pound of bread was worth an ounce of gold. One of the first measures of the government was to buy up all the corn that could be obtained in the neighborhood of Lisbon, and to sell it again at a moderate price to those who could afford to buy, distributing it gratis to those who had nothing to pay.

For about a month afterward earthquake shocks continued, some of them severe. It was several months before any of the citizens could summon courage to begin rebuilding the city. But by degrees their confidence returned. The earth had relapsed into repose, and they set about the task of rebuilding with so much energy, that in ten years Lisbon again became one of the most beautiful capitals of Europe.

CHARACTERISTICS OF THE LISBON EARTHQUAKE

The most distinguishing peculiarities of this earthquake were the swallowing up of the mole, and the vast extent of the earth's surface over which the shocks were felt. Several of the highest mountains in Portugal were violently shaken, and rent at their summits; huge masses falling from them into the neighboring valleys. These great fractures gave rise to immense volumes of dust, which at a distance were mistaken for smoke by those who beheld them. Flames were also said to have been observed: but if there were any such, they were probably electrical flashes produced by the sudden rupture of the rocks.

The portion of the earth's surface convulsed by this earthquake is estimated by Humboldt to have been four times greater than the whole extent of Europe. The shocks were felt not only over the Spanish peninsula, but in Morocco and Algeria they were nearly as violent. At a place about twenty-four miles from the city of Morocco, there is said to have occurred a catastrophe much resembling what took place at the Lisbon mole. A great fissure opened in the earth, and an entire village, with all its inhabitants, upwards of 8,000 in number, were precipitated into the gulf, which immediately closed over its prey.

EARTHQUAKES IN CALABRIA

Of the numerous other examples of destructive earthquakes which might be chosen from Old World annals, it will not be amiss to append a brief account of those which took place in Calabria, Italy, in 1783. These, while less wide-spread in their influence, were much longer in duration than the Lisbon cataclysm, since they continued, at intervals, from the 5th of February until the end of the year. The shocks were felt all over Sicily and as far north as Naples, but the area of severe convulsion was comparatively limited, not exceeding five hundred square miles.

The centre of disturbance seems to have been under the town of Oppido in the farther Calabria, and it extended in every direction from that spot to a distance of about twenty-two miles, with such violence as to overthrow every city, town and village lying within that circle. This ruin was accomplished by the first shock on the 5th of February. The second, of equal violence, on the 28th of March, was less destructive, only because little or nothing had been left for it to overthrow.

At Oppido the motion was in the nature of a vertical upheaval of the ground, which was accompanied by the opening of

numerous large chasms, into some of which many houses were ingulfed, the chasms closing over them again almost immediately. The town itself was situated on the summit of a hill, flanked by five steep and difficult slopes; it was so completely overthrown by the first shock that scarcely a fragment of wall was left standing. The hill itself was not thrown down, but a fort which commanded the approach to the place was hurled into the gorge below. It was on the flats immediately surrounding the site of the town and on the rising grounds beyond them that the great fissures and chasms were opened. On the slope of one of the hills opposite the town there appeared a vast chasm, in which a large quantity of soil covered with vines and olive-trees was engulfed. This chasm remained open after the shock, and was somewhat in the form of an amphitheatre, 500 feet long and 200 feet in depth.

MOST CALAMITOUS OF THE LANDSLIPS

The most calamitous of the landslips occurred on the sea-coast of the Straits of Messina, near the celebrated rock of Scilla, where huge masses fell from the tall cliffs, overwhelming many villas and gardens. At Gian Greco a continuous line of precipitous rocks, nearly a mile in length, tumbled down. The aged Prince of Scilla, after the first great shock on the 5th of February, persuaded many of his vassals to quit the dangerous shore, and take refuge in the fishing boats—he himself showing the example. That same night, however, while many of the people were asleep in the boats, and others on a flat plain a little above the sea-level, another powerful shock threw down from the neighboring Mount Jaci a great mass, which fell with a dreadful crash, partly into the sea, and partly upon the plain beneath. Immediately the sea rose to a height of twenty feet above the level ground on which the people were

stationed, and rolling over it, swept away the whole multitude. This immense wave then retired, but returned with still greater violence, bringing with it the bodies of the men and animals it had previously swept away, dashing to pieces the whole of the boats, drowning all that were in them, and wafting the fragments far inland. The prince with 1,430 of his people perished by this disaster.

It was on the north-eastern shore of Sicily, however, that the greatest amount of damage was done. The first severe shock, on the 5th of February, overthrew nearly the whole of the beautiful city of Messina, with great loss of life. The shore for a considerable distance along the coast was rent, and the ground along the port, which was before quite level, became afterwards inclined towards the sea, the depth of the water having, at the same time, increased in several parts, through the displacement of portions of the bottom. The quay also subsided about fourteen inches below the level of the sea, and the houses near it were much rent. But it was in the city itself that the most terrible desolation was wrought —a complication of disasters having followed the shock, more especially a fierce conflagration, whose intensity was augmented by the large stores of oil kept in the place.

IMMENSE DESTRUCTION

According to official reports made soon after the events, the destruction caused by the earthquakes of the 5th of February and 28th of March throughout the two Calabrias was immense. About 320 towns and villages were entirely reduced to ruins, and about fifty others seriously damaged. The loss of life was appalling—40,000 having perished by the earthquakes, and 20,000 more having subsequently died from privation and exposure, or from epidemic diseases bred by the stagnant pools and the decaying carcases of men

and animals. The greater number were buried amid the ruins of the houses, while others perished in the fires that were kindled in most of the towns, particularly in Oppido, where the flames were fed by great magazines of oil. Not a few, especially among the peasantry dwelling in the country, were suddenly engulfed in fissures. Many who were only half buried in the ruins, and who might have been saved had there been help at hand, were left to die a lingering death from cold and hunger. Four Augustine monks at Terranuova perished thus miserably. Having taken refuge in a vaulted sacristy, they were entombed in it alive by the masses of rubbish, and lingered for four days, during which their cries for help could be heard, till death put an end to their sufferings.

Of still more thrilling interest was the case of the Marchioness Spastara. Having fainted at the moment of the first great shock, she was lifted by her husband, who, bearing her in his arms, hurried with her to the harbor. Here, on recovering her senses, she observed that her infant boy had been left behind. Taking advantage of a moment when her husband was too much occupied to notice her, she darted off and, running back to the house, which was still standing, she snatched her babe from its cradle. Rushing with him in her arms towards the staircase, she found the stair had fallen—cutting off all further progress in that direction. She fled from room to room, pursued by the falling materials, and at length reached a balcony as her last refuge. Holding up her infant, she implored the few passers-by for help ; but they all, intent on securing their own safety, turned a deaf ear to her cries. Meanwhile the mansion had caught fire, and before long the balcony, with the devoted lady still grasping her darling, was hurled into the devouring flames.

CHAPTER XVII.

Earthquakes in the New World Prior to 1900.

THE twin continents of America have rivalled the record of the Old World in their experience of earthquakes since their discovery in 1492. The first of these made note of was in Venezuela in 1530, but they have been numerous and often disastrous since. Among them was the great shock at Lima in 1740, by which 18,000 were killed, and those at Guatemala in 1773, with 33,000, and at Riobamba in 1797, with 41,000 victims. It will, however, doubtless prove of more interest to our readers if we pass over these ruinous disasters and confine ourselves to the less destructive earthquakes which have taken place within our own country.

The United States, large a section of North America as it occupies, is fortunate in being in a great measure destitute of volcanic phenomena, while destructive earthquakes have been very rare in its history. This, it is true, does not apply to the United States as it is, but as it was. It has annexed the volcano and the earthquake with its new accessions of territory. Alaska has its volcanoes, the Philippines are subject to both forms of convulsion, and in Hawaii we possess the most spectacular volcano of the earth, while the earthquake is its common attendant. But in the older United States the volcano contents itself with an occasional puff of smoke, and eruptive phenomena are confined to the minor form of the geyser.

We are by no means so free from the earthquake. Slight movements of the earth's surface are much more common than many of us imagine, and in the history of our land there have been a number of earth shocks of considerable violence. Prior to that of San Francisco, the most destructive to life and property was that of Charleston in 1886, though the 1812 convulsion in the Mississippi Valley might have proved a much greater calamity but for the fact that civilized man had not then largely invaded its centre of action.

As regards the number of earth movements in this country, we are told that in New England alone 231 were recorded in two hundred and fifty years, while doubtless many slighter ones were left unrecorded. Taking the whole United States, there were 364 recorded in the twelve years from 1872 to 1883, and in 1885 fifty-nine were recorded, more than two-thirds of them being on the Pacific slope. Most of these, however, were very slight, some of them barely perceptible.

Confining ourselves to those of the past important in their effects, we shall first speak of the shocks which took place in New England in 1755, in the year and month of the great earthquake at Lisbon. On the 18th of November of that year, while the shocks at Lisbon still continued, New England was violently shaken, loud underground explosive noises accompanying the shocks. In the harbors along the Atlantic coast there was much agitation of the waters and many dead fish were thrown up on the shores. The shock, indeed, was felt far from the coast, by the crew of a ship more than two hundred miles out at sea from Cape Ann, Massachusetts.

This event, however, was of minor importance, being much inferior to that of 1812, in which year California and the Mississippi Valley alike were affected by violent movements of the earth's

crust. The California convulsions took place in the spring and summer of that year, extending from the beginning of May until September. Throughout May the southern portion of that region was violently agitated, the shocks being so frequent and severe that people abandoned their houses and slept on the open ground. The most destructive shocks came in September, when two Mission houses were destroyed and many of their inmates killed. At Santa Barbara a tidal wave invaded the coast and flowed some distance into the interior.

It may be said here that California has proved more subject to severe shocks than any other section of our country. In 1865 sharp tremors shook the whole region about the Bay of San Francisco, many buildings being thrown down. Hardly any of brick or stone escaped injury, though few lives were lost. In 1872 a disturbance was felt farther west, the whole range of the Sierra Nevada mountains being violently shaken and the earth tremblings extending into the State of Nevada. The centre of activity was along the crest of the range, and immense quantities of rock were thrown down from the mountain pinnacles. A tremendous fissure opened along the eastern base of the mountain range for forty miles, the land to the west of the opening rising and that to the east sinking several feet. One small settlement, that of Lone Pine, in Owen's Valley, on the east base of the mountains, was completely demolished, from twenty to thirty lives being lost. Luckily, the region affected had very few inhabitants, or the calamity might have been great.

The earthquakes of 1812 in the Mississippi Valley began in December, 1811, and continued at intervals until 1813. As a rule they were more distinguished by frequency than violence, though on several occasions they were severe and had marked effects.

They extended through the valleys of the Mississippi, Arkansas and Ohio, and their long continuance was remarkable in view of the territory affected being far from any volcanic region.

The surface of the valley of the Mississippi was a good deal altered by these convulsions—several new lakes being formed, while others were drained. Several new islands were also raised in the river, and during one of the shocks the ground a little below New Madrid was for a short time lifted so high as to stop the current of the Mississippi, and cause it to flow backward. The ground on which this town is built, and the bank of the river for fifteen miles above it, subsided permanently about eight feet, and the cemetery of the town fell into the river. In the neighboring forest the trees were thrown into inclined positions in every direction, and many of their trunks and branches were broken. It is affirmed that in some places the ground swelled into great waves, which burst at their summits and poured forth jets of water, along with sand and pieces of coal, which were tossed as high as the tops of trees. On the subsidence of these waves, there were left several hundreds of hollow depressions from ten to thirty yards in diameter, and about twenty feet in depth, which remained visible for many years afterward. Some of the shocks were vertical, and others horizontal, the latter being the most mischievous. These earthquakes resulted in the general subsidence of a large tract of country, between seventy and eighty miles in length from north to south, and about thirty miles in breadth from east to west. Lakes now mark many of the localities affected by the earthquake movements. It is only to the fact that this country was then very thinly settled that a great loss of life was avoided.

New Madrid, Missouri, was a central point of this earthquake, the shocks there being repeated with great frequency for several

months. The disturbance of the earth, however, was not confined to the United States, but affected nearly half of the western hemisphere, ending in the upheaval of Sabrina in the Azores, already described. The destruction of Caracas, Venezuela, with many thousands of its inhabitants, and the eruption of La Soufriere volcano of St. Vincent Island were incidents of this convulsion. Dr. J. W. Foster tells us that on the night of the disaster at Caracas the earthquake grew intense at New Madrid, fissures being opened six hundred feet long by twenty broad, from which water and sand were flung to the height of forty feet.

The most destructive of earthquakes in our former history was that which visited Charleston, South Carolina, in 1886, the injury caused by it being largely due to the fact that it passed through a populous city. As it occurred after many of the people had retired, the confusion and terror due to it were greatly augmented, people fleeing in panic fear from the tumbling and cracking houses to seek refuge in the widest streets and open spaces.

South Carolina had been affected by the wide-spread earthquakes of 1812. These in some cases altered the level of the land, as is related in Lyell's "Principles of Geology." But the effect then was much less than in 1886. Several slight tremors occurred in the early summer of that year, but did not excite much attention. More distinct shocks were felt on August 27th and 28th, but the climax was deferred till the evening of August 31st. The atmosphere that afternoon had been unusually sultry and quiet, the breeze from the ocean, which generally accompanies the rising tide, was almost entirely absent, and the setting sun caused a little glow in the sky.

"As the hour of 9.50 was reached," we are told, "there was suddenly heard a rushing, roaring sound, compared by some to a

train of cars at no great distance, by others to a clatter produced by two or more omnibuses moving at a rapid rate over a paved

RUINOUS EFFECT OF THE CHARLESTON EARTHQUAKE.

street, by others again, to an escape of steam from a boiler. It was followed immediately by a thumping and beating of the earth beneath the houses, which rocked and swayed to and fro. Furniture

was violently moved and dashed to the floor; pictures were swung from the walls, and in some cases turned with their backs to the front, and every movable thing was thrown into extraordinary convulsions. The greatest intensity of the shock is considered to have been during the first half, and it was probably then, during the period of its greatest sway, that so many chimneys were broken off at the junction of the roof. The duration of this severe shock is thought to have been from thirty-five to forty seconds. The impression produced on many was that it could be subdivided into three distinct movements, while others were of the opinion that it was one continuous movement, or succession of waves, with the greatest intensity, as already stated, during the first half of its duration."

Twenty-seven persons were killed outright, and more than that number died soon after of their hurts or from exposure; many others were less seriously injured. Among the buildings, the havoc, though much less disastrous than has been recorded in some other earthquakes in either hemisphere, was very great. "There was not a building in the city which had escaped serious injury. The extent of the damage varied greatly, ranging from total demolition down to the loss of chimney tops and the dislodgment of more or less plastering. The number of buildings which were completely demolished and levelled to the ground was not great; but there were several hundreds which lost a large portion of their walls. There were very many also which remained standing, but so badly shattered that public safety required that they should be pulled down altogether. There was not, so far as at present is known, a brick or stone building which was not more or less cracked, and in most of them the cracks were a permanent disfigurement and a source of danger and inconvenience." In some

places the railway track was curiously distorted. "It was often displaced laterally, and sometimes alternately depressed and elevated. Occasionally several lateral flexures of double curvature and of great amount were exhibited. Many hundred yards of track had been shoved bodily to the south eastward."

The ground was fissured at some places in the city to a depth of many feet, and numerous "craterlets" were formed, from which sand was ejected in considerable quantities. These are not uncommon phenomena, and were due, no doubt, to the squirting of water out of saturated sandy layers not far below the surface; these being squeezed between two less pervious beds in the passage of the earthquake wave. The ejected material in the Charleston earthquake was ordinary sand, such as might exist in many districts which had been quite undisturbed by any concussions of the earth.

Captain Dutton made a careful study of the observations collected by himself and others concerning this earthquake, and came to the conclusion that the Charleston wave traveled with unusual speed, for its mean velocity was about 17,000 feet a second. The focus of the disturbance was also ascertained. Apparently it was a double one, the two centres being about thirteen miles apart, and the line joining them running nearly the same distance to the west of Charleston. The approximate depth of the principal focus is given as twelve miles, with a possible error of less than two miles; that of the minor one as roughly eight miles.

The Charleston earthquake was felt as a tremor of more or less force through a wide area, embracing 900,000 square miles, and affecting nearly the whole country east of the Mississippi. It is said that the yield of the Pennsylvania natural gas wells decreased, and that a geyser in the Yellowstone valley burst into action after

four years of rest. The movement of the earth-wave was in general north and south, deflected to east and west, and the snake-like fashion in which rails on the railroad were bent indicated both a vertical and a lateral force.

This earthquake has been attributed to various causes, but geological experts think that it was due to a slip in the crust along the Appalachian Mountain chain. There is a line of weakness along the eastern slope of this chain, characterized by fissures and faults, and it was thought that a strain had been gradually brought to bear upon this through the removal of earth from the land by rains and rivers and its deposition in thick strata on the sea-bottom. It is supposed that this variation in weight in time caused a yielding of the strata and a slip seaward of the great coastal plain. Professor Mendenhall, however, thinks it was due to a readjustment of the earth's crust to its gradually sinking nucleus.

CHAPTER XVIII.

The San Francisco Calamity and Other Earthquakes of the Twentieth Century.

GREATEST among the American cities of the Pacific coast is San Francisco, seated on its splendid bay and an active metropolis of Pacific commerce. The one bane of its existence is its perilous liability to earthquakes, fully 250 shocks having been recorded within its history. Greatest of these was that which we have now to record.

On the 17th of April, 1906, the city was, as usual, gay, careless, busy, its people attending to business or pleasure with their ordinary vim as inclination led them, and not a soul dreaming of the horrors that lay in wait. They were as heedless of coming peril and death as the inhabitants of Sodom and Gomorrah before the rain of fire from heaven descended upon their devoted heads. This is not to say that they were doomed by God to destruction like these "cities of the plains." We should more wisely say that the forces of ruin within the earth take no heed of persons or places. They come and go as the conditions of nature demand, and if man has built one of his cities across their destined track, its doom comes from its situation, not from the moral state of its inhabitants.

THE GREAT DISASTER OF 1906.

That night the people went, with their wonted equanimity, to their beds, rich and poor, sick and well alike. Did any of them dream of disaster in the air? It may be so, for often, as the poet tell us, "Coming events cast their shadows before." But, fore-

warned by dreams or not, doubtless not a soul in the great city was prepared for the terrible event so near at hand, when, at thirteen minutes past five o'clock on the dread morning of the 18th, they felt their beds lifted beneath them as if by a Titan hand, heard the crash of falling walls and ceilings, and saw everything in their rooms tossed madly about, while through their windows came the roar of an awful disaster from the city without.

It was a matter not of minutes, but of seconds, yet on all that coast, long the prey of the earthquake, no shock like it had ever been felt, no such sudden terror awakened, no such terrible loss occasioned as in those few fearful seconds. Again and again the trembling of the earth passed by, three quickly repeated shocks, and the work of the demon of ruin was done. People woke with a start to find themselves flung from their beds to the floor, many of them covered with the fragments of broken ceilings, many lost among the ruins of falling floors and walls, many pinned in agonizing suffering under the ruins of their houses, which had been utterly wrecked in those fatal seconds. Many there were, indeed, who had been flung to quick if not to instant death under their ruined homes.

Those seconds of the reign of the elemental forces had turned the gayest, most careless city on the continent into a wreck which no words can fitly describe. Those able to move stumbled in wild panic across the floors of their heaving houses, regardless of clothing, of treasures, of everything but the mad instinct for safety, and rushed headlong into the streets, to find that the earth itself had yielded to the energy of its frightful interior forces and had in places been torn and rent like the houses themselves. New terrors assailed the fugitives as fresh tremors shook the solid ground, some of them strong enough to bring down shattered walls and chimneys, and

bring back much of the mad terror of the first fearful quake. The heaviest of these came at eight o'clock. While less forcible than that which had caused the work of destruction, it added immensely to the panic and dread of the people and put many of the wanderers to flight, some toward the ferry, the great mass in the direction of the sand dunes and Golden Gate Park.

The spectacle of the entire population of a great city thus roused suddenly from slumber by a fierce earthquake shock and sent flying into the streets in utter panic, where not buried under falling walls or tumbling debris, is one that can scarcely be pictured in words, and can be given in any approach to exact realization only in the narratives of those who passed through its horrors and experienced the sensations to which it gave rise. Some of the more vivid of these personal accounts will be presented later, but at present we must confine ourselves to a general statement of the succession of events.

The earthquake proved but the beginning and much the least destructive part of the disaster. In many of the buildings there were fires, banked for the night, but ready to kindle the inflammable material hurled down upon them by the shock. In others were live electric wires which the shock brought in contact with woodwork. The terror-stricken fugitives saw, here and there, in all directions around them, the alarming vision of red flames curling upward and outward, in gleaming contrast to the white light of dawn just showing in the eastern sky. Those lurid gleams climbed upward in devouring haste, and before the sun had fairly risen a dozen or more conflagrations were visible in all sections of the business part of the city, and in places great buildings broke with startling suddenness into flame, which shot hotly high into the air.

While the mass of the people were stunned by the awful suddenness of the disaster and stood rooted to the ground or wandered helplessly about in blank dismay, there were many alert and self-possessed among them who roused themselves quickly from their dismay and put their energies to useful work. Some of these gave themselves to the work of rescue, seeking to save the injured from their perilous situation and draw the bodies of the dead from the ruins under which they lay. Those base wretches to whom plunder is always the first thought were as quickly engaged in seeking for spoil in edifices laid open to their plundering hands by the shock. Meanwhile the glare of the flames brought the fire-fighters out in hot haste with their engines, and up from the military station at the Presidio, on the Golden Gate side of the city, came at double quick a force of soldiers, under the efficient command of General Funston, of Cuban and Philippine fame. These trained troops were at once put on guard over the city, with directions to keep the best order possible, and with strict command to shoot all looters at sight. Funston recognized at the start the necessity of keeping the lawless element under control in such an exigency as that which he had to face. Later in the day the First Regiment of California National Guards was called out and put on duty, with similar orders.

RESCUERS AND FIRE-FIGHTERS.

The work of fighting the fire was the first and greatest duty to be performed, but from the start it proved a very difficult, almost a hopeless, task. With fierce fires burning at once in a dozen or more separate places, the fire department of the city would have been inadequate to cope with the demon of flame even under the best of circumstances. As it was, they found themselves handicapped at

the start by a nearly total lack of water. The earthquake had disarranged and broken the water mains and there was scarcely a drop of water to be had, so that the engines proved next to useless. Water might be drawn from the bay, but the centre of the conflagration was a mile or more away, and this great body of water was rendered useless in the stringent exigency.

The only hope that remained to the authorities was to endeavor to check the progress of the flames by the use of dynamite, blowing up buildings in the line of progress of the conflagration. This was put in practice without loss of time, and soon the thunder-like roar of the explosions began, blasts being heard every few minutes, each signifying that some building had been blown to atoms. But over the gaps thus made the flames leaped, and though the brave fellows worked with a desperation and energy of the most heroic type, it seemed as if all their labors were to be without avail, the terrible fire marching on as steadily as if a colony of ants had sought to stay its devastating progress.

THE HORROR OF THE PEOPLE.

It was with grief and horror that the mass of the people gazed on this steady march of the army of ruin. They were seemingly half dazed by the magnitude of the disaster, strangely passive in the face of the ruin that surrounded them, as if stunned by despair and not yet awakened to a realization of the horrors of the situation. Among these was the possibility of famine. No city at any time carries more than a few days' supply of provisions, and with the wholesale districts and warehouse regions invaded by the flames the shortage of food made itself apparent from the start. Water was even more difficult to obtain, the supply being nearly all cut off. Those who

possessed supplies of food and liquids of any kind in many cases took advantage of the opportunity to advance their prices. Thus an Associated Press man was obliged to pay twenty-five cents for a small glass of mineral water, the only kind of drink that at first was to be had, while food went up at the same rate, bakers frequently charging as much as a dollar for a loaf. As for the expressmen and cabmen, their charges were often practically prohibitory, as much as fifty dollars being asked for the conveyance of a passenger to the ferry. Policemen were early stationed at some of the retail shops, regulating the sale and the price of food, and permitting only a small portion to be sold to each purchaser, so as to prevent a few persons from exhausting the supply.

The fire, the swaying and tottering walls, the frequent dynamite explosions, each followed by a crashing shower of stones and bricks, rendered the streets very unsafe for pedestrians, and all day long the flight of residents from the city went on, growing quickly to the dimensions of a panic. The ferryboats were crowded with those who wished to leave the city, and a constant stream of the homeless, carrying such articles as they had rescued from their homes, was kept up all day long, seeking the sand dunes, the parks and every place uninvaded by the flames. Before night Golden Gate Park and the unbuilt districts adjoining on the ocean side presented the appearance of a tented city, shelter of many kinds being improvised from bedding and blankets, and the people settling into such sparse comfort as these inadequate means provided.

A strange feature of the disaster was a rush to the banks by people who wished to get their money and flee from the seemingly doomed city. The fire front was yet distant from these institutions, which were destined to fall a prey to the flames, and all that morning

lines of dishevelled and half-frantic men stood before the banks on Montgomery and Sansome Strets, braving in their thirst for money the smoke and falling embers and beating in wild anxiety upon the doors. Their effort was vain; the doors remained closed; finally the police drove these people away, and the banks went on with the work of saving their valuables. As for the people who wildly fled toward the ferries, in spite of the fact that ten blocks of fire, as the day went on, stopped all egress in that direction, it became necessary for them to be driven back by the police and the troops, and they were finally forced to seek safety in the sands. And thus, with incident manifold, went on that fatal Wednesday, the first day of the dread disaster.

OFFICIAL RECORD OF THE EARTHQUAKE.

It is important here to give the official record of the earthquake shocks, as given by the scientists. Professor George Davidson, of the University of California, says of them:

"The earthquake came from north to south, and the only description I am able to give of its effect is that it seemed like a terrier shaking a rat. I was in bed, but was awakened by the first shock. I began to count the seconds as I went towards the table where my watch was, being able through much practice closely to approximate the time in that manner. The shock came at 5.12 o'clock. The first sixty seconds were the most severe. From that time on it decreased gradually for about thirty seconds. There was then the slightest perceptible lull. Then the shock continued for sixty seconds longer, being slighter in degree in this minute than in any part of the preceding minute and a half. There were two slight shocks afterwards which I did not time. At 8.14 o'clock I recorded a shock of

five seconds' duration, and one at 4.15 of two seconds. There were slight shocks which I did not record at 5.17 and at 5.27. At 6.50 P. M. there was a sharp shock of several seconds."

Professor A. O. Louschner, of the students' observatory of the University of California, thus records his observations:

"The principal part of the earthquake came in two sections, the first series of vibrations lasting about forty seconds. The vibrations diminished gradually during the following ten seconds, and then occurred with renewed vigor for about twenty-five seconds more. But even at noon the disturbance had not subsided, as slight shocks are recorded at frequent intervals on the seismograph. The motion was from south-southeast to north-northwest.

"The remarkable feature of this earthquake, aside from its intensity, was its rotary motion. As seen from the print, the sum total of all displacements represents a very regular ellipse, and some of the lines representing the earth's motion can be traced along the whole circumference. The result of observation indicates that our heaviest shocks are in the direction south-southeast to north-northwest. In that respect the records of the three heaviest earthquakes agree entirely. But they have several other features in common. One of these is that while the displacements are very large the vibration period is comparatively slow, amounting to about one second in the last two big earthquakes."

If we seek to discover the actual damage done by the earthquake, the fact stands out that the fire followed so close upon it that the traces of its ravages were in many cases obliterated. So many buildings in the territory of the severest shock fell a prey to the flames or to dynamite that the actual work of the earth forces was made difficult and in many places impossible to discover. This fact

was on that led to considerable dispute and delay when the question of insurance adjustment came up, many of the insurance companies having confined their risk to fire damage and claiming exemption from liability in the case of damage due to earthquake.

Among the chief victims of the earth-shake was the costly and showy City Hall, with its picturesque dome standing loftily above the structure. This dome was left still erect, but only as a skeleton might stand, with its flesh gone and its spare ribs exposed to the searching air. Its roof, its smaller towers came tumbling down in frightful disarray, and the once proud edifice is to-day a miserable wreck, fire having aided earthquake in its ruin. The new Post Office, a handsome government building, also suffered severely from the shock, its walls being badly cracked and injury done by earthquake and fire that it is estimated will need half a million dollars to repair.

FREAKS OF THE EARTHQUAKE.

One observer states that the earthquake appeared to be very irregular in its course. He tells us that "there are gas reservoirs with frames all twisted and big factories thrown to the ground, while a few yards away are miserable shanties with not a board out of place. Wooden, steel and brick structures hardly felt the earthquake in some parts of the city, while in other places all were wrecked.

"Skirting the shore northwest from the big ferry building—which was so seriously injured that it will have to be rebuilt—the first thing observed was the extraordinary irregularity of the earthquake's course. Pier No. 5, for instance, is nothing but a mass of ruins, while Pier No. 3, on one side of it and Pier No. 7, on the other

side, similar in size and construction, are undamaged. Farther on, the Kosmos Line pier is a complete wreck."

The big forts at the entrance to the Golden Gate also suffered seriously from the great shake-up, and the emplacements of the big guns were cracked and damaged. The same was the case with the fortifications back of Old Fort Point, the great guns in these being for the time rendered useless. It took much time and labor to restore their delicate adjustment upon their carriages.

The buildings that collapsed in the city were all flimsy wooden buildings and old brick structures, the steel frame buildings, even the score or more in course of construction, escaping injury from the earthquake shock. Of the former, one of the most complete wrecks was the Valencia Hotel, a four-story wooden building, which collapsed into a heap of ruins, pinning many persons under its splintered timbers.

SKYSCRAPERS EARTHQUAKE PROOF.

In fact, as the reports of damage wrought by the earthquake came in, the conviction grew that one of the safest places during the earthquake shock was on one of the upper floors of the skyscraper office buildings or hotels. As a matter of fact, not a single person, so far as can be learned, lost his or her life or was seriously injured in any of the tall, steel frame structures in the city, although they rocked during the quake like a ship in a gale.

The loss of life was caused in almost every case by the collapse of frame structures, which the native San Franciscan believed was the safest of all in an earthquake, or by the shaking down of portions of brick or stone buildings which did not possess an iron framework. The manner in which the tall steel structures withstood the shock

is a complete vindication of the strongest claims yet made for them, and it is made doubly interesting from the fact that this is the first occasion on which the effect of an earthquake of any proportions on a tall steel structure could be studied.

The St. Francis Hotel, a sixteen-story structure, could be repaired at an expenditure of about $400,000, its damage being almost wholly by fire. The steel shell and the floors were intact. Although the building rocked like a ship in a gale while the quake lasted, its foundations were undamaged. Other steel buildings which were so little damaged as to admit of repairs more or less extensive were the James Flood, the Union Trust, the *Call* building, the Mutual Savings Bank, the Crocker-Woolworth building and the Postal building. All of these were modern buildings of steel construction, from sixteen to twenty stories.

A peculiar feature of the effect of the earthquake on structures of this kind is reported in the case of the Fairmount Hotel, a fourteen-story structure. The first two stories of the Fairmount were found to be so seriously damaged that they would have to be rebuilt, while the other twelve stories were uninjured.

Various explanations have been made of the surprising resistance shown by the skyscrapers. The great strength and binding power of the steel frame, combined with a deep-seated foundation and great lightness as compared with buildings of stone, are the main reasons given. The iron, it is said, unlike stone, responded to the vibratory force and passed it along to be expended in other directions, while brick or stone offered a solid and impenetrable front, with the result that the seismic force tended to expend itself by shaking the building to pieces.

Whether there is any scientific basis for the latter theory or

not, it seems reasonable enough, in view of the descriptions given us of the manner in which the steel buildings received the shock. All things considered, the modern steel building has afforded in the San Francisco earthquake the most convincing evidence of its strength.

From Golden Gate Park came news of the total destruction of the large building covering a portion of the Children's playground. The walls were shattered beyond repair, the roof fell in, and the destruction was complete. The pillars of the new stone gates at the park entrance were twisted and torn from their foundations, some of them, weighing nearly four tons, being shifted as though they were made of cork. It is a little singular that the monuments and statues in the city escaped without damage except in the case of the imposing Dewey Monument, in Union Square Park, which suffered what appears to be a minor injury.

In this connection an incident of extraordinary character is narrated. Among the statues on the buildings of the Leland Stanford, Jr., University, all of which were overthrown, was a marble statue of Carrara in a niche on the building devoted to zoology and physiology. This in falling broke through a hard cement pavement and buried itself in the ground below, from which it was dug. The singular fact is that when recovered it proved to be without a crack or scratch. This university seemed to be a central point in the disturbance, the destruction of its buildings being almost total, though they had been built with the especial design of resisting earthquake shocks.

Such was the general character of the earthquake at San Francisco and in its vicinity. It may be said farther that all, or very nearly all, the deaths and injuries were due to it directly or indirectly,

even those who perished by fire owing their deaths to the fact of their being pinned in buildings ruined by the earthquake shock, while others were killed by falling walls weakened by the same cause.

On the night of April 23d the earth tremor returned with a slight shock, only sufficient to cause a temporary alarm. On the afternoon of the 25th came another and severer one, strong enough to shake down some tottering walls and add another to the list of victims. This was a woman named Annie Whitaker, who was at work in the kitchen of her home at the time. The chimney, which had been weakened by the great shock, now fell, crashing through the roof and fracturing her skull. Thus the earth powers claimed a final human sacrifice before their dread visitation ended.

FIRE INVADES THE CITY.

The terrors of the earthquake are momentary. One fierce, levelling shock and usually all is over. The torment within the earth has passed on and the awakened forces of the earth's crust sink into rest again, after having shaken the surface for many leagues. Rarely does the dread agent of ruin leave behind it such a terrible follower to complete its work as was the case in the doomed city of San Francisco. All seemed to lead towards such a carnival of ruin as the earth has rarely seen. The demon of fire followed close upon the heels of the unseen fiend of the earth's hidden caverns, and ran red-handed through the metropolis of the West, kindling a thousand unhurt buildings, while the horror-stricken people stood aghast in terror, as helpless to combat this new enemy as they were to check the ravages of the earthquake itself.

The iron mains which carried the precious fluid under the city

streets were broken or injured so that no quenching streams were to be had. In some cases the engine houses had been so damaged that the fire-fighting apparatus could not be taken out, though even if it had it would have been useless. A sweeping conflagration and not an ounce of water to throw upon it! The situation of the people was a maddening one. They were forced helplessly and hopelessly to gaze upon the destruction of their all, and it is no marvel if many of them grew frantic and lost their reason at the sight. Thousands gathered and looked on in blank and pitiful misery, their strong hands, their iron wills of no avail, while the red-lipped fire devoured the hopes of their lives.

In a dozen, a hundred, places the flames shot up redly. Huge, strong buildings which the earthquake had spared fell an unresisting prey to the flames. The great, iron-bound, towering Spreckles building, a steeple-like structure, of eighteen stories in height, the tallest skyscraper in the city, had resisted the earthquake and remained proudly erect. But now the flames gathered round and assailed it. From both sides came their attack. A broad district near by, containing many large hotels and lodging houses, was being fiercely burnt out, and soon the windows of the lofty building cracked and splintered, the flames shot triumphantly within, and almost in an instant the vast interior was a seething furnace, the wild flames rushing and leaping within until only the blackened walls remained.

All day Wednesday the fire spread unchecked, all efforts to stay its devouring fury proving futile. In the business section of the city everything was in ruins. Not a business house was left standing. Theatres crumbled into smouldering heaps. Factories and commission houses sank to red ruin before the devouring flames.

The scene was like that of ancient Babylon in its fall, or old Rome when set on fire by Nero's command, as tradition tells. In modern times there has been nothing to equal it except the conflagration at Chicago, when the flames swept to ruin that queen city of the Great Lakes.

When night fell and the sun withdrew his beams the spectacle was one at once magnificent and awe-inspiring. The city resembled one vast blazing furnace. Looking over it from a high hill in the western section, the flames could be seen ascending skyward for miles upon miles, while in the midst of the red spirals of flame could be seen at intervals the black skeletons and falling towers of doomed buildings. Above all this hung a dense pall of smoke, showing lurid where the flames were reflected from its dark and threatening surface. To those nearer the scene presented many pathetic and distressing features, the fire glare throwing weird shadows over the worn and panic-stricken faces of the woe-begone fugitives, driven from their homes and wandering the streets in helpless misery. Many of them lay sleeping on piles of blankets and clothing which they had brought with them, or on the hard sidewalks, or the grass of the open parks.

FIRE ATTACKS THE MINT.

The escape of the United States Mint was one of the most remarkable incidents. Within the vaults of this fine structure was the vast sum of $300,000,000 in gold and silver coin and a value of $8,000,000 in bullion, and toward this mighty sum of wealth the flames swept on all sides, as if eager to add the reservoir of the precious metals to their spoils. The Mint building passed through the earthquake with little damage, though its big smokestacks were

badly shaken. The fire seemed bent on making it its prey, every building around it being burned to the ground, and it remaining the only building for blocks that escaped destruction.

Its safety was due to the energy and activity of its employees. Superintendent Leach reached it shortly after the shock and found a number of men already there, whom he stationed at points of vantage from roof to basement. The fire apparatus of the Mint was brought into service and help given by the fire department, and after a period of strenuous labor the flames were driven back. The peril for a time was critical, the windows on Mint Avenue taking fire and also those on the rear three stories, and the flames for a time pouring in and driving back the workers. The roof also caught fire, but the men within fought like Titans, and efficient aid was given by a squad of soldiers sent to them. In the end the fire fiend was vanquished, though considerable damage was done to the adjusting rooms and the refinery, while the heavy stone cornice on that side of the building was destroyed. The total loss to the Mint was later estimated at $15,000.

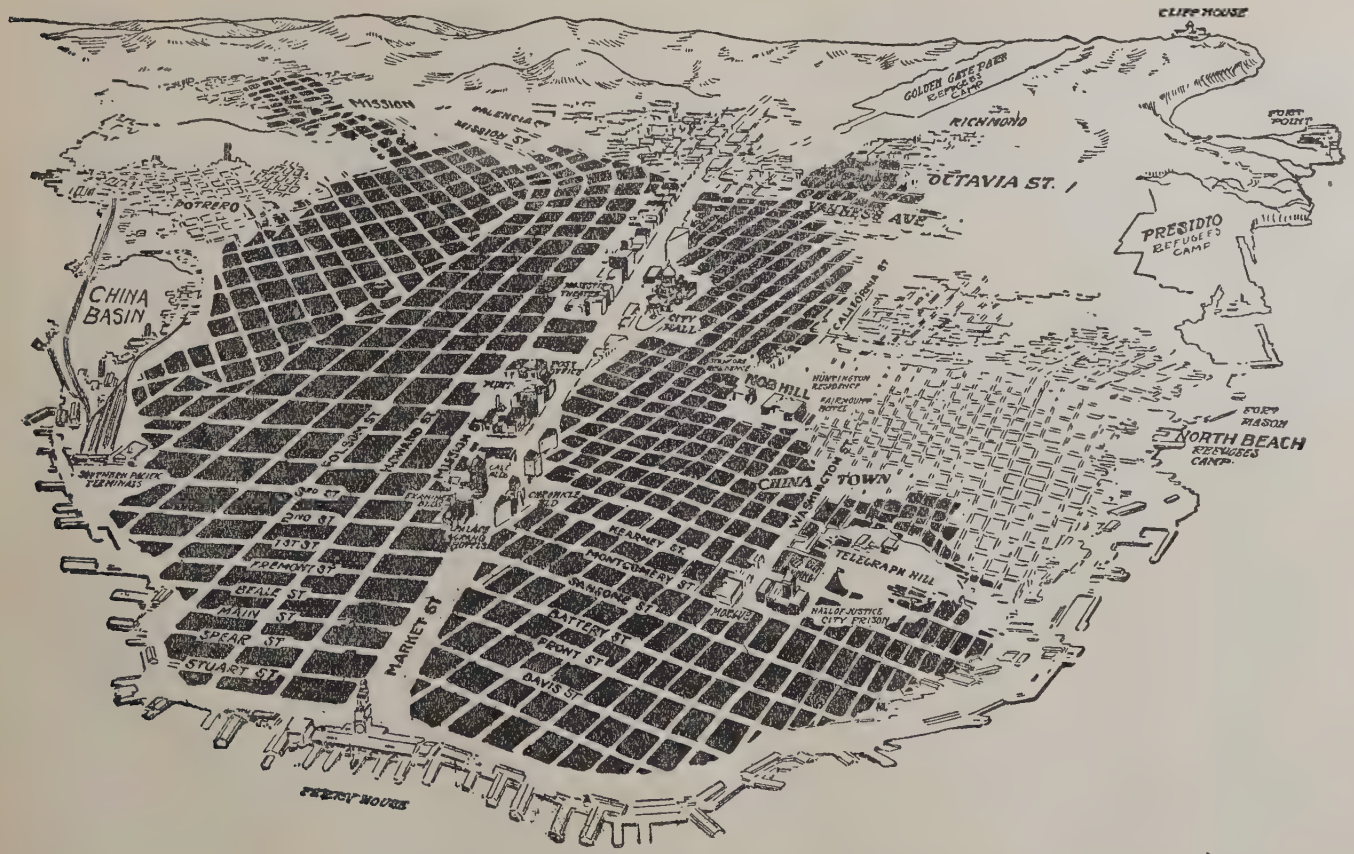
Late on Wednesday evening the fire front crept close up to Mechanics' Pavilion, where a corps of fifty physicians and numerous nurses were active in the work of relief to the wounded. Ambulances and automobiles were busy unloading new patients rescued from the ruins when word came that the building would have to be vacated in haste. Every available vehicle was at once pressed into service and the patients removed as rapidly as possible, being taken to hospitals and private houses in the safer parts of the city. Hardly had the last of the injured been carried through the door when the roof was seen to be in a blaze, and shortly afterward the whole building burst into a whirlwind of flame.

At midnight the fire was raging and roaring with unslacked rage, and at dawn of Thursday its fury was undiminished. The work of destruction was already immense. In much of the Hayes Valley district, south of McAllister and north of Market Street, the destruction was complete. From the Mechanics' Pavilion and St. Nicholas Hotel opposite down to Oakland Ferry the journey was heartrending, the scene appalling. On each side was ruin, nothing but ruin, and hillocks of masonry and heaps of rubbish of every description filled to its middle the city's greatest thoroughfare.

THE PALACES ON NOB'S HILL.

In the centre of San Francisco rises the aristocratic elevation known as Nob's Hill, on which the early millionaires built their homes, and on which stood the city's most palatial residences. It ascends so abruptly from Kearney Street that it is inaccessible to any kind of vehicle, the slope being at an angle little short of forty-five degrees. It is as steep on the south side, and the only approach by carriage is from the north. To this hill is due the pioneer cable railway, built in the early '70's.

Here the "big four" of the railroad magnates—Stanford Hopkins, Huntington and Crocker—had put millions in their mansions, the Mark Hopkins residence being said to have cost $2,500,000. These men are all dead, and the last named edifice has been converted into the Hopkins Art Institute, and at the time of the fire was well filled with costly art treasures. The Stanford Museum, which also contains valuable objects of art, is now the property of the Leland Stanford University. The Flood mansion, which cost more than $1,000,000, was one of the showy residences on this hill, west of it being the Huntington home and farther west the Crocker



THE DEVASTATED AREA OF SAN FRANCISCO.

Bird'seye view of the portion destroyed by earthquake and fire.

residence, with its broad lawns and magnificent stables. Many other beautiful and costly houses stood on this hill, and opposite the Stanford and Hopkins edifices the great Fairmount Hotel had for two years past been in process of construction and was practically completed. On the northeastern slope of this hill stood the famous Chinatown, through which it was necessary to pass to ascend Nob's Hill from the principal section of the wholesale district.

This region of palaces was the next to fall a prey to the insatiable flames. Early Thursday morning a change in the wind sent the fire westward, eating its way from the water front north of Market Street toward Nob's Hill. Steadily but surely it climbed the slope, and the Stanford and Hopkins edifices fell victims to its fury. Others of the palaces of the millionairedom followed. Huge clouds of smoke enveloped the beautiful white stone Fairmount Hotel, and there was a general feeling of horror when this magnificent structure seemed doomed. To it the Committee of Safety had retreated, but the flames from the burning buildings opposite reached it, and the committee once more migrated in search of safe quarters. Fortunately, it escaped with little damage, its walls remaining intact and much of the interior being left in a state of preservation, warranting its managers to offer space within it to the committees whose aim it was to help the homeless or to store supplies. Some of the woodwork of the building was destroyed by the fire, but the structure was in such good condition that work on it was quickly resumed, with the statement that its completion would not be delayed more than three months beyond the date set, which was November, 1906.

In the district extending northwestwardly from Kearney Street and Montgomery Avenue, untouched during the first day, the fire

spread freely on the second. This district embraces the Latin quarter, peopled by various nationalities, the houses being of the flimsiest construction. Once it had gained a foothold there, the fire swept onward as though making its way through a forest in the driest summer season.

An apocryphal incident is told of the fire in this quarter, which may be repeated as one example of the fables set afloat. It is stated that water to fight the fire here was sadly lacking, the only available supply being from an old well. At a critical moment the pump sucked dry, the water in the well being exhausted. The residents were not yet conquered. Some of them threw open their cellar doors and, calling for assistance, began to roll out barrels of red wine. Barrel after barrel appeared, until fully five hundred gallons were ready for use. Then the barrel heads were smashed in and the bucket brigade turned from water to wine. Sacks were dipped in the wine and used for fighting the fire. Beds were stripped of their blankets and these soaked in the wine and hung over exposed portions of the cottages, while men on the roofs drenched the shingles and sides of the houses with wine. The postscript to this queer story is that the wine won and the fire-fighters saved their homes. The story is worth retelling, though it may be added that wine, if it contained much alcohol, would serve as a feeder rather than as an extinguisher of flame.

Shaken by earthquake, swept by flames, the water supply cut off by the breaking of the mains, what could be done to stay the fierce march of the flames which were sweeping resistlessly over palace and hovel alike, over stately hall and miserable hut? Water was not to be had; what was to take its place? Nothing remained but to meet ruin with ruin, to make a desert in the path of the fire

and thus seek to stop its march. They had dynamite, gunpowder and other explosives, and in the frightful exigency there was nothing else to be used. Only for a brief interval did the authorities yield to the general feeling of helplessness. Then they aroused themselves to the demands of the occasion and prepared to do all in the power of man in the effort to arrest the conflagration.

A band of fire-fighters was quickly organized by the Mayor and Chief of Police, and the devoted firemen put themselves in the face of the flames, determined to do their utmost to stay them in their course. Cut off from the use of their accustomed engines and water streams, which might have been effective if brought into play at the beginning of the struggle, there was nothing to work with but the dynamite cartridge and the gunpowder mine, and they set bravely to work to do what they could with these. On every side the roar of explosions could be heard, and the crash of falling walls came to the ear, while people were forced to leave buildings which still stood, but which it was decided must be felled. Frequently a crash of stone and brick, followed by a cloud of dust, gave warning to pedestrians that destruction was going on in the forefront of the flames, and that travel in such localities was unsafe.

FIGHTING THE FLAMES.

All through the night of Wednesday and the morning of Thursday this work went on, hopelessly but resolutely. During the following day blasts could be heard in different sections at intervals of a few minutes, and buildings not destroyed by fire were blown to atoms, but over the gaps jumped the live flames, and the disheartened fire-fighters were driven back step by step; but they continued the work with little regard for their own safety and with unflinching desperation.

The engines almost from the start had proved useless from lack of water, and were either abandoned or moved to the outlying districts, in the vain hope that the water mains might be repaired in time to permit of a final stand against the whirlwind march of the flames. The cloud of despair grew darker still as the report spread that the city's supply of dynamite had given out.

"No more dynamite! No more dynamite!" screamed a fireman as he ran up Ellis Street past the doomed Flood building at two o'clock on Friday morning, tears standing in his smoke-smirched eyes.

"No more dynamite! O God! no more dynamite! We are lost!" moaned the throng that heard his despairing words.

A NEW SUPPLY OF EXPLOSIVES.

So, at that hour, the supply of the explosive exhausted, and not a dozen streams of water being thrown in the entire fire zone, the stunned firemen and the stupefied people stood helpless with their eyes fixed in despair upon the swiftly creeping flames.

Had all been like these the entire city would have been doomed, but there were those at the head of affairs who never for a moment gave up their resolution. Dynamite and giant powder were to be had in the Presidio military reservation, and a requisition upon the army authorities was made. The louder reverberations as the day advanced and night came on showed that a fresh supply had been obtained, and that a new and determined campaign against the conflagration had been entered upon. Hitherto much of the work had been ignorantly and carelessly done, and by the hasty and premature use of explosives more harm than good had been occasioned.

As the fire continued to spread in spite of the heroic work of the fighting corps, the Committee of Safety called a meeting at noon on Friday and decided to blow up all the residences on the east side of Van Ness Avenue, between Golden Gate and Pacific Avenues, a distance of one mile. Van Ness Avenue was one of the most fashionable streets of the city and has a width of 125 feet, a fact which led to the idea that a safety line might be made here too broad for the flames to cross.

The firemen, therefore, although exhausted from over twenty-four hours' work and lack of food, determined to make a desperate stand at this point. They declared that should the fire cross Van Ness Avenue and the wind continue its earlier direction toward the west, the destruction of San Francisco would be virtually complete. The district west of Van Ness Avenue and north of McAllister constituted the finest part of the metropolis. Here were located all of the finer homes of the well-to-do and wealthier classes, and the resolution to destroy them was the last resort of desperation.

Hundreds of police, regiments of soldiers and scores of volunteers were sent into the doomed district to warn the people to flee. They heroically responded to the demand of law and went bravely on their way, leaving their loved homes and trudging painfully over the pavements with the little they could carry away of their treasured possessions.

The reply of a grizzled fire engineer standing at O'Farrell Street and Van Ness Avenue, beside a blackened engine, may not have been as terse as that of Hugo's guardsman at Waterloo, but the pathos of it must have been as great. In answer to the question of what they proposed to do, he said:

"We are waiting for it to come. When it gets here we will

make one more stand. If it crosses Van Ness Avenue the city is gone."

THE SAVERS OF THE CITY.

Yet the work now to be done was much too important to be left to hands of untrained volunteers. Skilled engineers were needed, a man used to the scientific handling of explosives, and it was men of this kind who finally saved what is left to-day of the city. Three men saved San Francisco, so far as any San Francisco existed after the fire had worked its will, these three constituting the dynamite squad who faced and defied the demon at Van Ness Avenue.

When the burning city seemed doomed and the flames lit the sky farther and farther to the west, Admiral McCalla sent a trio of his most trusted men from Mare Island with orders to check the conflagration at any cost of property. With them they brought a ton and a half of guncotton. The terrific power of the explosive was equal to the maniac determination of the fire. Captain MacBride was in charge of the squad, Chief Gunner Adamson placed the charges and the third gunner set them off.

Stationing themselves on Van Ness Avenue, which the conflagration was approaching with leaps and bounds from the burning business section of the city, they went systematically to work, and when they had ended a broad open space, occupied only by the dismantled ruins of buildings, remained of what had been a long row of handsome and costly residences, which, with all their treasures of furniture and articles of decoration, had been consigned to hideous ruin.

The thunderous detonations, to which the terrified city listened all that dreadful Friday night, meant much to those whose ears were

deafened by them. A million dollars' worth of property, noble residences and worthless shacks alike, were blown to drifting dust, but that destruction broke the fire and sent the raging flames back over their own charred path. The whole east side of Van Ness Avenue, from the Golden Gate to Greenwich, a distance of twenty-two blocks, or a mile and a half, was dynamited a block deep, though most of the structures as yet had stood untouched by spark or cinder. Not one charge failed. Not one building stood upon its foundation.

Unless some second malicious miracle of nature should reverse the direction of the west wind, by nine o'clock it was felt that the populous district to the west, blocked with fleeing refugees and unilluminated except by the disastrous glare on the water front, was safe. Every pound of guncotton did its work, and though the ruins burned, it was but feebly. From Golden Gate Avenue north the fire crossed the wide street in but one place. That was at the Claus Spreckels place, on the corner of California Street.

There the flames were writhing up the walls before the dynamiters could reach the spot. Yet they made their way to the foundations, carrying their explosives, despite the furnace-like heat. The charge had to be placed so swiftly and the fuse lit in such a hurry that the explosion was not quite successful from the trained viewpoint of the gunners. But though the walls still stood, it was only an empty victory for the fire, as bare brick and smoking ruins are poor food for flames.

Captain MacBride's dynamiting squad had realized that a stand was hopeless except on Van Ness Avenue, their decision thus coinciding with that of the authorities. They could have forced their explosives farther in the burning section, but not a pound of guncotton could be or was wasted. The ruined blocks of the wide

thoroughfare formed a trench through the clustered structures that the conflagation, wild as it was, could not leap. Engines pumping brine through Fort Mason from the bay completed the little work that the guncotton had left, but for three days the haggard-eyed firemen guarded the flickering ruins.

The desolate waste straight through the heart of the city remained a mute witness to the most heroic and effective work of the whole calamity. Three men did this, and when their work was over and what stood of the city rested quietly for the first time, they departed as modestly as they had come. They were ordered to save San Francisco, and they obeyed orders, and Captain MacBride and his two gunners made history on that dreadful night.

They stayed the march of the conflagration at that critical point, leaving it no channel to spread except along the wharf region, in which its final force was spent. One side of Van Ness Avenue was gone; the other remained, the fire leaping the broad open space only feebly in a few places, where it was easily extinguished.

During the height of the struggle and the days of exhaustion and depression that followed, exaggerated accounts of the losses and of the area swept by the flames were current, some estimate making the extent of the fire fifteen square miles out of the total of twenty-five square miles of the city's area. It was not until Friday, the 27th, that an official survey of the burned district, made by City Surveyor Woodward, was completed, and the total area burned over found to be 2,500 acres, a trifle less than four square miles. This, however, embraced the heart of the business section and many of the principal residence streets, much of the saved area being occupied by the dwellings of the poorer people, so that the money loss was immensely greater than the percentage of ground burned over would indicate.

Fortunately, the loss of life was very small compared with the extent of the disaster, and with the records of other cities similarly overthrown. As regards the whole number killed it was impossible to make a full and accurate statement. While about 350 bodies had been recovered at the end of the second week, no one could estimate how many lay buried under the ruins, to be discovered only as the work of excavation went on, and how many more had been utterly consumed by the flames, leaving no trace of their existence. The estimates of the probable loss of life ran up to 1,500 and more, while the injured were very numerous. The great bulk of the people escaped, fleeing to the open park in the western section of the city and to the ferries leading to Oakland, which had met with little damage.

SANTA ROSA AND SAN JOSE.

The San Francisco earthquake was far from being a local catastrophe, since the full force of the seismic waves travelled from Ukiah in the north to Monterey in the south, a distance of about 180 miles, and made itself felt for a considerable distance from the Pacific westward, wrecking the larger buildings of every town in its path, rending and ruining as it went, and doing millions of dollars worth of damage.

In Santa Rosa, sixty miles to the north of San Francisco, and one of the most beautiful towns of California, practically every building was destroyed or badly damaged. The brick and stone business blocks, together with the public buildings, were thrown down. The Court House, Hall of Records, the Occidental and Santa Rosa Hotels, the Athenæum Theatre, the new Masonic Temple, Odd Fellows' Block, all the banks, everything went, and in

all the city not one brick or stone building was left standing, except the California Northwestern Depot.

In the residential portion of the city the foundations receded from under the houses, badly wrecking about twenty of the largest and damaging every one more or less; and here, as in San Francisco, flames followed the earthquake, breaking out in a dozen different places at once and completing the work of devastation. From the ruins of the fallen houses fifty-eight bodies were taken out and interred during the first few days, and the total of dead and injured was close to a hundred. The money loss at this small city is estimated at $3,000,000.

The destruction of Santa Rosa gave rise to general sorrow among the residents of the interior of the State. It was one of the show towns of California, and not only one of the most prosperous cities in the fine county of Sonoma, but one of the most picturesque in the State. Surrounding it there were miles of orchards, vineyards and corn fields. The beautiful drives of the city were adorned with bowers of roses, which everywhere were seen growing about the homes of the people. In its vicinity are the famous gardens of Luther Burbank, the "California wizard," but these fortunately escaped injury.

At San Jose, another very beautiful city of over 20,000 population, not a single brick or stone building of two stories or over was left standing. Among those wrecked were the Hall of Justice, just completed at a cost of over $300,000; the new High School, the Presbyterian Church and St. Patrick's Cathedral. Numbers of people were caught in the ruins and maimed or killed. The death list appears to have been small, but the property damage was not less than $5,000,000. The Agnew State Insane Asylum, in the

vicinity of San Jose, was entirely destroyed, more than half the inmates being killed or injured.

THE STANFORD UNIVERSITY.

The Leland Stanford, Jr., University, at Palo Alto (about thirty miles south of San Francisco), felt the full force of the earthquake and was badly wrecked. Only two lives were lost as a result of the earthquake, one of a student, the other of a fireman, but eight students were injured more or less seriously. The damage to the buildings is estimated by President Jordan to amount to about $4,000,000.

The memorial church, with its twelve marble figures of the apostles, each weighing two tons, was badly injured by the fall of its Gothic spire, which crashed through the roof and demolished much of the interior; the great entrance archway was split in twain and wrecked; so, too, were the library, the gymnasium and the power houes. A number of other buildings in the outer quadrangle and some of the small workshops were seriously damaged.

Encina Hall and the inner quadrangle were practically uninjured, and the bulk of the books, collections and apparatus escaped damage.

Sacramento, together with all the smaller cities and towns that dot the great Sacramento Valley for a distance of fifty miles south and 150 miles north of the capital, escaped without injury, not a single pane of glass being broken or a brick displaced in Sacramento and no injury done in the other places, they lying eastward of the seat of serious earthquake activity.

Los Angeles and Santa Barbara escaped with a slight trembling; Stockton, 103 miles north of San Francisco, felt a severe

shock and the Santa Fe bridge over the San Joaquin River at this point settled several inches. The only place in Southern California that suffered was Brawley, a small town lying 120 miles south of Los Angeles, about 100 buildings in the town and the surrounding valley being injured, though none of them were destroyed.

THE EARTHQUAKE AT OTHER CITIES.

At Alameda, on the bay opposite San Francisco, a score of chimneys were shaken down and other injuries done. Railroad tracks were twisted, and over 600 feet of track of the Oakland Transit Company's railway sank four feet. The total damage done amounted to probably $200,000, but no lives were lost. Tomales, a place of 350 inhabitants, was left a pile of ruins.

At Los Panos several buildings were wrecked, causing damage to the extent of $75,000, but no lives were lost.

At Loma Prieta the earthquake caused a mine house to slip down the side of a mountain, ten men being buried in the ruins.

Fort Bragg, one of the principal lumbering towns in Mendocino County, was practically wiped out by fire following the earthquake, but out of a population of 5,000 only one was killed, though scores were injured.

The town of Berkeley, across the bay from San Francisco, suffered considerable damage from twisted structures, fallen walls and broken chimneys, the greatest injury being in the collapse of the town hall and the ruin of the deaf and dumb asylum. The University of California, situated here, was fortunate in escaping injury, it being reported that not a building was harmed in the slightest degree. Another public edifice of importance and interest,

in a different section of the State, the famous Lick Astronomical Observatory, was equally fortunate, no damage being done to the buildings or the instruments.

THE EFFECTS AT SALINAS.

Salinas, a town down the coast near Monterey, suffered severely, the place being to a large extent destroyed, with an estimated loss of over $1,000,000. The Spreckles' sugar factory and a score of other buildings were reported ruined and a number of lives lost. During the succeeding week several other shocks of some strength were reported from this town.

Thus the ruinous work of the earthquake stretched over a broad track of prosperous, peaceful and happy country, embracing one of the best sections of California, laying waste not only the towns in its path, but doing much damage to ranch houses and country residences. Strange manifestations of nature were reported from the interior, where the ground was opened in many places like a ploughed field. Great rents in the earth were reported, and for many miles north from Los Angeles miniature geysers are said to have spouted volcano-like streams of hot mud.

Railroad tracks in some localities were badly injured, sinking or lifting, and being put out of service until repaired. In fact, the ruinous effects of the earthquake immensely exceeded those of any similar catastrophe ever before known in the United States, and when the destruction done by the succeeding conflagration in San Francisco is taken into account the California earthquake of 1906 takes rank with the most destructive of those recorded in history.

AMERICA TO THE RESCUE.

We need not go into the details of the prompt and abundant measures of relief which followed the disaster. It must suffice to say here that during the first three days after the news had been received, the nation had subscribed $5,000,000 for the relief of the sufferers, $2,500,000 of this being the contribution of the United States government, while supplies of every variety were sent to the scene of disaster with the utmost rapidity. The sum named was largely increased as the days passed on, and President Roosevelt was enabled to decline the generous offers of aid from Canada and Europe, which he did with thanks for their messages of sympathy and kindly offers.

EARTH CONVULSIONS OF 1902 AND 1903.

An extended space has been given here to the description of the earthquake disaster at San Francisco, on account of the great size and importance of that city and the interest which it naturally possesses for the people of this country. But the twentieth century has been one of numerous earthquake outbreaks in America, some of them very serious in their results, though in most cases of not sufficient importance to us to warrant more than a brief statement.

The year 1902 was one of remarkable seismic activity, in various parts of the world, among which especial interest attaches to the terrific volcanic explosion of Mount Pelee, in Martinique, with the destruction of the city of St. Pierre and its entire population. This disaster has been described in detail in a separate chapter and needs no further mention here, other than to say that it was attended with earthquake shocks which made themselves evident at great

distances. On May 30th there was a severe earthquake, the effects of which were felt as far north as New Jersey, and on June 8th, Guatemala, in Central America, was violently shaken, several towns being destroyed and more than a thousand people killed.

Venezuela was sharply shaken on July 9th, many towns being damaged, and later in the month there were severe shocks in California. On August 30th, during an eruption of Mount Pelee, Venezuela was again shaken, the earth shocks being accompanied by a tremendous noise, heard along the whole shore of the Caribbean Sea, and on September 23d, during a violent eruption of Mount Soufriere, earthquake shocks of great severity were felt as far apart as Jamaica and Ecuador.

Passing to the following year, 1903, we find it to have been one of great earthquake disturbances in many parts of the globe, beginning with severe shocks on January 22-27, in the State of Chihuahua, Mexico. There were earthquake disturbances in the central United States on February 8th, and at Sioux Falls, South Dakota, on the 25th, and on March 18th, at the Arrowhead, in the Selkirk Range of the Rocky Mountains, Canada, a mountain collapsed and fell into a lake, dense clouds of smoke accompanying the disaster. A similar occurrence took place April 29th, at Frank, Northwest Territory, Canada. Here a mountain of huge size burst with terrific force, killing more than a hundred persons and damming with its debris a large river to the depth of a hundred feet. In the valley around the mountain the earth swayed to and fro and a vast crevasse, a mile long and of unknown depth, was opened. With the explosion there fell a huge mass of rock, cinders, and dust, which buried the houses and their inhabitants to a depth of twenty-five to fifty feet, millions of tons of rock being thrown out by the eruptive energies.

THE BURNING CITY AS SEEN FROM AN APPROACHING VESSEL.
Pillars of smoke stood over the doomed city for days. The ferryboat in the right foreground is loaded with refugees rushing to safety. The buildings on higher ground which were not swept by the tidal waves were consumed by the flames.

Copyright, 1906, Judge Co.

A TERRIBLE BUT MAGNIFICENT SPECTACLE PHOTOGRAPHED IN THE CENTRE OF SAN FRANCISCO.

Panorama of the heart of the business district, in which all the buildings were destroyed or badly damaged by the earthquake and the fire during the terrible catastrophe of 1906.

Copyright, 1906, Judge Co.

HUGE SKY-SCRAPERS THREATENED BY THE SWIFTLY ADVANCING FLAMES IN SAN FRANCISCO ON APRIL 19, 1906.

The Hayward Building at the left, Merchants' Exchange in the central background and the Mills Building at the right. This remarkable photograph shows the demon of fire at the height of its destructive violence.

KILAUEA, THE GREAT VOLCANO OF HAWAII.
The flow of lava is seen in the picture.

This was volcanic in character, and the year throughout was notable for volcanic activity, there being violent eruptions at various periods by Mount Stromboli and Vesuvius in the Mediterranean region, Mt. Santa Maria, in Guatemala, and Cotopaxi in South America, the latter, the highest volcano on the earth, while constantly steaming and smoking, had been comparatively dormant since 1803, but burst into violent eruption in 1903, a century later.

THE VALPARAISO DISASTER.

After this date the earth's surface remained comparatively quiet until 1906, when began a series of earthquakes of great severity and destructiveness, including those of San Francisco and Valparaiso in this year and that of Kingston, Jamaica, in January, 1907, and ending with the most destructive to human life of all, that of Messina in December, 1908. Of these the Valparaiso and Kingston shocks call here for some description.

The cycle opened with a terrific earth shock on March 17, 1906, on the island of Formosa, in the China Sea, by which thousands of the inhabitants were killed and a property loss resulted, estimated at $45,000,000. This was quickly followed by the San Francisco disaster, and on August 16-17, by a destructive shock at Valparaiso, Chile. This, as in the case of San Francisco, was followed by a destructive fire, the property loss being fully $100,000,000. The loss of life was also considerable.

This city and its vicinity have a memorable record in this direction, it having been at various times violently shaken. In 1705 almost the entire city was laid in ruins, and in 1851, four hundred houses were destroyed. Santiago, inland from Valparaiso, was partly destroyed in 1822, a long portion of the coast of Chile being

permanently raised. In 1829 the same city was again shaken, and the lifted coast was lowered to several feet below its original level.

THE KINGSTON EARTHQUAKE.

The year 1907 opened in this field with a violent earthquake on January 14th at Kingston, the capital and chief commercial city of the island of Jamaica, which practically destroyed it and killed more than a thousand of its people. Kingston is, in a sense, a child of the earthquake, owing its existence and importance to the destruction of Port Royal, the former capital, by an earthquake in 1692. It stands on the north side of a land-locked harbor, for its size one of the best in the world, and since 1872 has been the capital of the island. It has not been free from former disasters. A violent hurricane visited it in 1880, and in December, 1892, it was well-nigh consumed by fire. Its third disaster was that of January 14, 1907, above mentioned, when the city was shaken to its foundations by severe earth tremors and a thousand or more of its inhabitants buried beneath its ruins, while many more were injured by the shock. As in all such cases, the charity of the world was directed to this centre of disaster, and the United States was as usual prompt in sending aid to the sufferers.

THE MONTESSUS RECORD.

The remaining American earthquake of which we need to speak at this point was that of April 15, 1907, which destroyed two cities of Mexico, those of Chilpancingo and Chialpi, great loss of life attending their overthrow. It is desirable, however, to speak at this point of the great catalogue of earthquakes recently completed, after years of labor, by Major de Montessus de Balore, which sup-

plements that of Mallet, mentioned in another chapter. This embraces no fewer than 130,000 shocks, of which trustworthy details have been procured, and indicates with some scientific accuracy how these symptoms of seismic activity are distributed over the earth. The period of observation includes generally the last fifty years, and the most shaken regions of the earth appear to be Italy, Japan, Greece, South America (the Pacific Coast), Java, Sicily, and Asia Minor. The lands most free from such convulsions are Africa, Australia, Russia, Siberia, Scandinavia and Canada. Italy and Japan have each experienced more than 27,000 shocks.

As a rule, where earthquakes are most frequent they are most severe, though there are exceptions to this, the comparatively few earthquakes in India being often very disastrous. Yet loss of life in many cases depends more upon density of population than on the intensity of the earth's vibrations.

CHAPTER XIX.

The Volcano and the Earthquake, Earth's Demons of Destruction.

TO most of us, dwellers upon the face of the earth, this terrestrial sphere is quite a comfortable place of residence. The forces of Nature everywhere and at all times surround us, forces capable, if loosened from their bonds, of bringing death and destruction to man and the work of his hands. But usually they are mild and beneficent in their action, not agents of destruction and lords of elemental misrule. The air, without whose presence we could not survive a minute, is usually a pleasant companion, now resting about us in soft calm, now passing by in mild breezes. The alternation of summer and winter is to us generally an agreeable relief from the monotony of a uniform climate. The variation from sunlight to cloud, from dry weather to rainfall, is equally viewed as a pleasant escape from the weariness of too great fixity of natural conditions. The change from day to night, from hours of activity to hours of slumber, are other agreeable variations in the events of our daily life. In short, a great pendulum seems to be swinging above us, held in Nature's kindly hand, and adapting its movements to our best good and highest enjoyment.

But has Nature,—if we are justified in personifying the laws and forces of the universe,—has mother Nature really our pleasure and benefit in mind, or does she merely suffer us to enjoy life like so many summer insects, until she is in the mood to sweep us like

leaves from her path? It must seem the latter to many of the inhabitants of the earth, especially to the dwellers in certain ill-conditioned regions. For all the beneficent powers above named may at a moment's notice change to destructive ones.

THE WIND IS A DEMON IN CHAINS

The wind, for instance, is a demon in chains. At times it breaks its fetters and rushes on in mad fury, rending and destroying, and sweeping such trifles as cities and those who dwell therein to common ruin. Sunshine and rain are subject to like wild caprices. The sun may pour down burning rays for weeks and months together, scorching the fertile fields, drying up the life-giving streams, bringing famine and misery to lands of plenty and comfort, almost making the blood to boil in our veins. Its antithesis, the rainstorm, is at times a still more terrible visitant. From the dense clouds pour frightful floods, rushing down the lofty hills, sweeping over fertile plains, overflowing broad river valleys, and, wherever they go, leaving terror and death in their path. We may say the same of the alternation of the seasons. Summer, while looked forward to with joyous anticipation, may bring us only suffering by its too ardent grasp; and winter, often welcomed with like pleasurable anticipations, may prove a period of terror from cold and destitution.

Such is the make-up of the world in which we live, such the vagaries of the forces which surround us. But those enumerated are not the whole. Can we say, with a stamp of the foot upon the solid earth, "Here at least I have something I can trust; let the winds blow and the rains descend, let the summer scorch and the winter chill, the good earth still stands firm beneath me, and of it at least I am sure?"

Who says so speaks hastily and heedlessly, for the earth can show itself as unstable as the air, and our solid footing become as insecure as the deck of a ship laboring in a storm at sea. The powers of the atmosphere, great as they are and mighty for destruction as they may become, are at times surpassed by those which abide within the earth, deep laid in the so-called everlasting rocks, slumbering often through generations, but at any time likely to awaken in wrath, to lift the earth into quaking billows like those of the sea, or pour forth torrents of liquid fire that flow in glowing and burning rivers over leagues of ruined land. Such is the earth with which we have to deal, such the ruthless powers of nature that spread around us and lurk beneath us, such the terrific forces which only bide their time to break forth and sweep too-confident man from the earth's smiling face.

THE SUBTERRANEAN POWERS

The subterranean powers here spoken of, those we had denominated earth's demons of destruction, are the volcano and the earthquake, the great moulding forces of the earth, tearing down to rebuild, rending to reconstitute, and in this elemental work often bringing ruin to man's boasted fanes and palaces.

No one who has ever seen a volcano or "burning mountain" casting forth steam, huge red-hot stones, smoke, cinders and lava, can possibly forget the grandeur of the spectacle. At night it is doubly terrible, when the darkness shows the red-hot lava rolling in glowing streams down the mountain's side. At times, indeed, the volcano is quiet, and only a little smoke curls from its top. Even this may cease, and the once burning summit may be covered over with trees and grass, like any other hill. But deep down in the earth the gases and pent-up steam, are ever preparing to force their

way upward through the mountain, and to carry with them dissolved rocks, and the stones which block their passage. Sometimes, while all is calm and beautiful on the mountains, suddenly deep-sounding noises are heard, the ground shakes, and a vast torrent tears its way through the bowels of the volcano, and is flung hundreds of feet high in the air, and, falling again to the earth, destroys every living thing for miles around.

It is the same with the earthquake as with the volcano. The surface of the earth is never quite still. Tremors are constantly passing onward which can be distinguished by delicate instruments, but only rarely are these of sufficient force to become noticeable, except by instrumental means. At intervals, however, the power beneath the surface raises the ground in long, billow-like motions, before which, when of violent character, no edifice or human habitation can for a moment stand. The earth is frequently rent asunder, great fissures and cavities being formed. The course of rivers is changed and the waters are swallowed up by fissures rent in the surface, while ruin impends in a thousand forms. The cities become death pits and the cultivated fields are buried beneath floods of liquid mud. Fortunately these convulsions, alike of the earthquake and volcano, are comparative rarities and are confined to limited regions of the earth's surface. What do we know of those deep-lying powers, those vast buried forces dwelling in uneasy isolation beneath our feet? With all our science we are but a step beyond the ancients, to whom these were the Titans, great rebel giants whom Jupiter overthrew and bound under the burning mountains, and whose throes of agony shook the earth in quaking convulsions. To us the volcanic crater is the mouth from which comes the fiery breath of demon powers which dwell far down in the earth's crust. The Titans themselves were dwarfs beside these

mighty agents of destruction whose domain extends for thousands of miles beneath the earth's surface and which in their convulsions shake whole continents at once. Such was the case in 1812, when the eruption of Mont Soufriere on St. Vincent, as told in a later chapter, formed merely the closing event in a series of earthquakes which had made themselves felt under thousands of miles of land.

ANCIENT AWE OF VOLCANOES

In olden times volcanoes were regarded with superstitious awe, and it would have been considered highly impious to make any investigation of their actions. We are told by Virgil that Mt. Etna marks the spot where the gods in their anger buried Enceladus, one of the rebellious giants. To our myth-making ancestors one of the volcanoes of the Mediterranean, set on a small island of the Lipari group, was the workshop of Vulcan, the god of fire, within whose depths he forged the thunderbolts of the gods. From below came sounds as of a mighty hammer on a vast anvil. Through the mountain vent came the black smoke and lurid glow from the fires of Vulcan's forge. This old myth is in many respects more consonant with the facts of nature than myths usually are. In agreement with the theory of its internal forces, the mountain in question was given the name of Volcano. To-day it is scarcely known at all, but its name clings to all the fire-breathing mountains of the earth.

As before said, at the present day we are little in advance of the ancients in actual knowledge of what is going on so far beneath our feet. We speak of forces where they spoke of fettered giants, but can only form theories where they formed myths. Is the earth's centre made up of liquid fire? Does its rock crust resemble the thick ice crust on the Arctic Seas, or is the earth, as later

scientists believe, solid to the core? Is it heated so fiercely, miles below our feet, that at every release of pressure the solid rock bursts into molten lava? Is the steam from the contact of underground rivers and deep-lying fires the origin of the terrible rending powers of the volcano's depths? Truly we can answer none of these questions with assurance, and can only guess and conjecture from the few facts open to us what lies concealed far beneath.

RARITY OF ANCIENT ACCOUNTS

In the history of earthquakes nothing is more remarkable than the extreme fewness of those recorded before the beginning of the Christian era, in comparison with those that have been registered since that time. It is to be borne in mind, however, that before the birth of Christ only a small portion of the globe was inhabited by those likely to make a record of natural events. The vast apparent increase in the number of earthquakes in recent times is owing to a greater knowledge of the earth's surface and to the spread of civilization over lands once inhabited by savages. The same is to be said of volcanic eruptions, which also have apparently increased greatly since the beginning of the Christian era. There may possibly have been a natural increase in these phenomena, but this is hardly probable, the change being more likely due to the increase in the number of observers.

The structure of a volcano is very different from that of other mountains, really consisting of layers of lava and volcanic ashes, alternating with each other and all sloping away from the center. These elevations, in fact, are formed in a different manner from ordinary mountains. The latter have been uplifted by the influence of pressure in the interior of the earth, but the volcano is an immediate result of the explosive force of which we have spoken, the mountain

being gradually built up by the lava and other materials which it has flung up from below. In this way mountains of immense height and remarkable regularity have been formed. Mount Orizabo, near the City of Mexico, for instance, is a remarkably regular cone, undoubtedly formed in this way, and the same may be said of Mount Mayon, on the Island of Luzon.

In many cases the irregularity of the volcano is due to subsequent action of its forces, which may blow the mountain itself to pieces. In the case of Krakatoa, in the East Indies, for instance, the whole mountain was rent into fragments, which were flung as dust miles high into the air. The main point we wish to indicate is that volcanoes are never formed by ordinary elevating forces and that they differ in this way from all other mountains. On the contrary, they have been piled up like rubbish heaps, resembling the small mountains of coal dust near the mouths of anthracite mines.

It is to the burning heat of the earth's crust and the influence of pressure, and more largely to the influx of water to the molten rocks which lie miles below the surface, that these convulsions of nature are due. Water, on reaching these overheated strata, explodes into volumes of steam, and if there is no free vent to the surface, it is apt to rend the very mountain asunder in its efforts to escape. Such is supposed to have been the case in the eruption of Krakatoa, and was probably the case also in the recent case of Mt. Pelee.

GENERAL DESCRIPTION OF ERUPTIONS

If we should seek to give a general description of volcanic eruptions, it would be in some such words as follows: An eruption is usually preceded by earthquakes which affect the whole surrounding country, and associated with which are underground explosions that seem like the sound of distant artillery. The mountain

quivers with internal convulsions, due to the efforts of its confined forces to find an opening. The drying up of wells and disappearance of springs are apt to take place, the water sinking downward through cracks newly made in the rocks. Finally the fierce unchained energy rends an opening through the crater and an eruption begins. It comes usually with a terrible burst that shakes the mountain to its foundation; explosions following rapidly and with increasing violence, while steam issues and mounts upward in a lofty column. The steam and escaping gases in their fierce outbreaks hurl up into the air great quantities of solid rock torn from the sides of the opening. The huge blocks, meeting each other in their rise and fall, are gradually broken and ground into minute fragments, forming dust or so-called ashes, often of extreme fineness, and in such quantities as frequently to blot out the light of the sun. There is another way in which a great deal of volcanic dust is made; the lava is full of steam, which in its expansion tears the molten rock into atoms, often converting it into the finest dust.

The eruption of Mt. Skaptar, in Iceland, in 1783, sent up such volumes of dust that the atmosphere was loaded with it for months, and it was carried to the northern part of Scotland, 600 miles away, in such quantities as to destroy the crops. During the eruption of Tomboro, in the East Indies, in 1815, so great was the quantity of dust thrown up that it caused darkness at midday in Java 300 miles away and covered the ground to a depth of several inches. Floating pumice formed a layer on the ocean surface two and a half feet in thickness, through which vessels had difficulty in forcing their way.

The steam which rises in large volumes into the air may become suddenly condensed with the chill of the upper atmosphere and fall as rain, torrents of which often follow an eruption. The rain, falling through the clouds of volcanic dust, brings it to the

earth as liquid mud, which pours in thick streams down the sides of the mountain. The torrents of flowing mud are sometimes on such a great scale that large towns, as in the instance of the great city of Herculaneum, may be completely buried beneath them. Over this city the mud accumulated to the depth of over 70 feet. In addition to these phenomena, molten lava often flows from the lip of the crater, occasionally in vast quantities. In the Icelandic eruption of 1783 the lava streams were so great in quantity as to fill river gorges 600 ft. deep and 200 ft. wide, and to extend over an open plain to a distance of 12 to 15 miles, forming lakes of lava 100 feet deep. The volcanoes of Hawaii often send forth streams of lava which cover an area of over 100 square miles to a great depth.

GREAT OUTFLOWS OF LAVA

In the course of ages lava outflows of this kind have built up in Hawaii a volcanic mountain estimated to contain enough material to cover the whole of the United States with a layer of rock 50 feet deep. These great outflows of lava are not confined to mountains, but take place now and then from openings in the ground, or from long cracks in the surface rocks. Occasionally great eruptions have taken place beneath the ocean's surface, throwing up material in sufficient quantity to form new islands.

The formation of mud is not confined to the method given, but great quantities of this plastic material flow at times from volcanic craters. In the year 1691 Imbaburu, one of the peaks of the Andes, sent out floods of mud which contained dead fish in such abundance that their decay caused a fever in the vicinity. The volcanoes of Java have often buried large tracts of fertile country under volcanic mud.

An observation of volcanoes shows us that they have three well marked phases of action. The first of these is the state of permanent eruption, as in case of the volcano of Stromboli in the Mediterranean. This state is not a dangerous one, since the steam, escaping continually, acts as a safety valve. The second stage is one of milder activity with an occasional somewhat violent eruption; this is apt to be dangerous, though not often very greatly so. The safety valve is partly out of order. The third phase is one in which long periods of repose, sometimes lasting for centuries, are followed by eruptions of intense energy. These are often of extreme violence and cause widespread destruction. In this case the safety valve has failed to work and the boiler bursts.

OFTEN REST FOR LONG TERMS OF YEARS

Such are the general features of action in the vast powers which dwell deep beneath the surface, harmless in most parts of the earth, frightfully perilous in others. Yet even here they often rest for long terms of years in seeming apathy, until men gather above their lurking places in multitudes, heedless or ignorant of the sleeping demons that bide their time below. Their time is sure to come, after years, perhaps after centuries. Suddenly the solid earth begins to tremble and quake; roars as of one of the buried giants of old strike all men with dread; then, with a fierce convulsion, a mountain is rent in twain and vast torrents of steam, burning rock, and blinding dust are hurled far upward into the air, to fall again and bury cities, perhaps, with all their inhabitants in indiscriminate ruin and death.

CHAPTER XX.

Theories of Volcanic and Earthquake Action.

THOUGH the first formation of a volcano (Italian, *vulcano*, from Vulcan, the Roman god of fire) has seldom been witnessed, it would seem that it is marked by earthquake movements followed by the opening of a rent or fissure; but with no such tilting up of the rocks as was once supposed to take place. From this fissure large volumes of steam issue, accompanied by hydrogen, nitrogen, carbon dioxide, hydrochloric acid, and sulphur dioxide. The hydrogen, apparently derived from the dissociation of water at a high temperature, flashes explosively into union with atmospheric oxygen, and, having exerted its explosive force, the steam condenses into cloud, heavy masses of which overhang the volcano, pouring down copious rains. This naturally disturbs the electrical condition of the atmosphere, so that thunder and lightning are frequent accompaniments of an eruption. The hydrochloric acid probably points to the agency of sea-water. Besides the gases just mentioned, sulphuretted hydrogen, ammonia and common salt occur; but mainly as secondary products, formed by the union of the vapors issuing from the volcano, and commonly found also in the vapors rising from cooling lava streams or dormant volcanic districts. It is important to notice that the vapors issue from the volcano spasmodically, explosions succeeding each other with great rapidity and noise.

All substances thrown out by the volcano, whether gaseous, liquid or solid, are conveniently united under the term *ejectamenta*

(Latin, things thrown out), and all of them are in an intensely heated, if not an incandescent state. Most of the gases are incombustible, but the hydrogen and those containing sulphur burn with a true flame, perhaps rendered more visible by the presence of solid particles. Much of the so-called flame, however, in popular descriptions of eruptions is an error of observation due to the red-hot solid particles and the reflection of the glowing orifice on the overhanging clouds.

ENORMOUS FORCE DISPLAYED

Solid bodies are thrown into the air with enormous force and to proportionally great heights, those not projected vertically falling in consequence at considerable distances from the volcano. A block weighing 200 tons is said to have been thrown nine miles by Cotopaxi; masses of rock weighing as much as twenty tons to have been ejected by Mount Ararat in 1840; and stones to have been hurled to a distance of thirty-six miles in other cases The solid matter thrown out by volcanoes consists of *lapilli*, *scoriæ*, *dust* and *bombs*.

Though on the first formation of the volcano, masses of non-volcanic rock may be torn from the chimney or pipe of the mountain, only slightly fused externally owing to the bad conducting power of most rocks, and hurled to a distance; and though at the beginning of a subsequent eruption the solid plug of rock which has cooled at the bottom of the crater, or, in fact, any part of the volcano, may be similarly blown up, the bulk of the solid particles of which the volcano itself is composed is derived from the lake of lava or molten rock which seethes at the orifice. Solid pieces rent from this fused mass and cast up by the explosive force of the steam with which the lava is saturated are known as *lapilli*. Cooling

rapidly so as to be glassy in texture externally, these often have time to become perfectly crystalline within.

Gases and steam escaping from other similar masses may leave them hollow, when they are termed *bombs*, or may pit their surfaces with irregular bubble-cavities, when they are called *scoriæ* or *scoriaceous*. Such masses whirling through the air in a plastic state often become more or less oblately spheroidal in form; but, as often, the explosive force of their contained vapors shatters them into fragments, producing quantities of the finest volcanic dust or sand. This fine dust darkens the clouds overhanging the mountain, mixes with the condensed steam to fall as a black mud-rain, or *lava di aqua* (Italian, water lava), or is carried up to enormous heights, and then slowly diffused by upper currents of the atmosphere. In the eruption of Vesuvius of A.D. 79, the air was dark as midnight for twelve or fifteen miles round; the city of Pompeii was buried beneath a deposit of dry *scoriæ*, or ashes and dust, and Herculaneum beneath a layer of the mud-like *lava di aqua*, which on drying sets into a compact rock. Rocks formed from these fragmentary volcanic materials are known as tuff.

VOLCANIC CONES HAVE SIMILAR CURVATURES

It is entirely of these cindery fragments heaped up with marvellous rapidity round the orifice that the volcano itself is first formed. It may, as in the case of Jorullo in Mexico in 1759, form a cone several hundred feet high in less than a day. Such a cone may have a slope as steep as 30° or 40°, its incline in all cases depending simply on the angle of repose of its materials, the inclination, that is, at which they stop rolling. The great volcanoes of the Andes, which are formed mainly of ash, are very steep. Owing to a general similarity in their materials, volcanic cones in

Copyright, 1906, by Judge Publishing Co.

FIRE RAVAGING MARKET STREET, SAN FRANCISCO, IN 1906.
The principal street of San Francisco's business centre. It was one of the first quarters to be devastated by the flames. House after house succumbed, but the lofty "Call" or Spreckles building remained standing.

SAN FRANCISCO'S CITY HALL.
This photograph shows what was left of the recently completed $7,000,000 City Hall after earthquake and fire had demolished it in 1906.

A FAMOUS VOLCANO, ORIZABA, MEXICO.

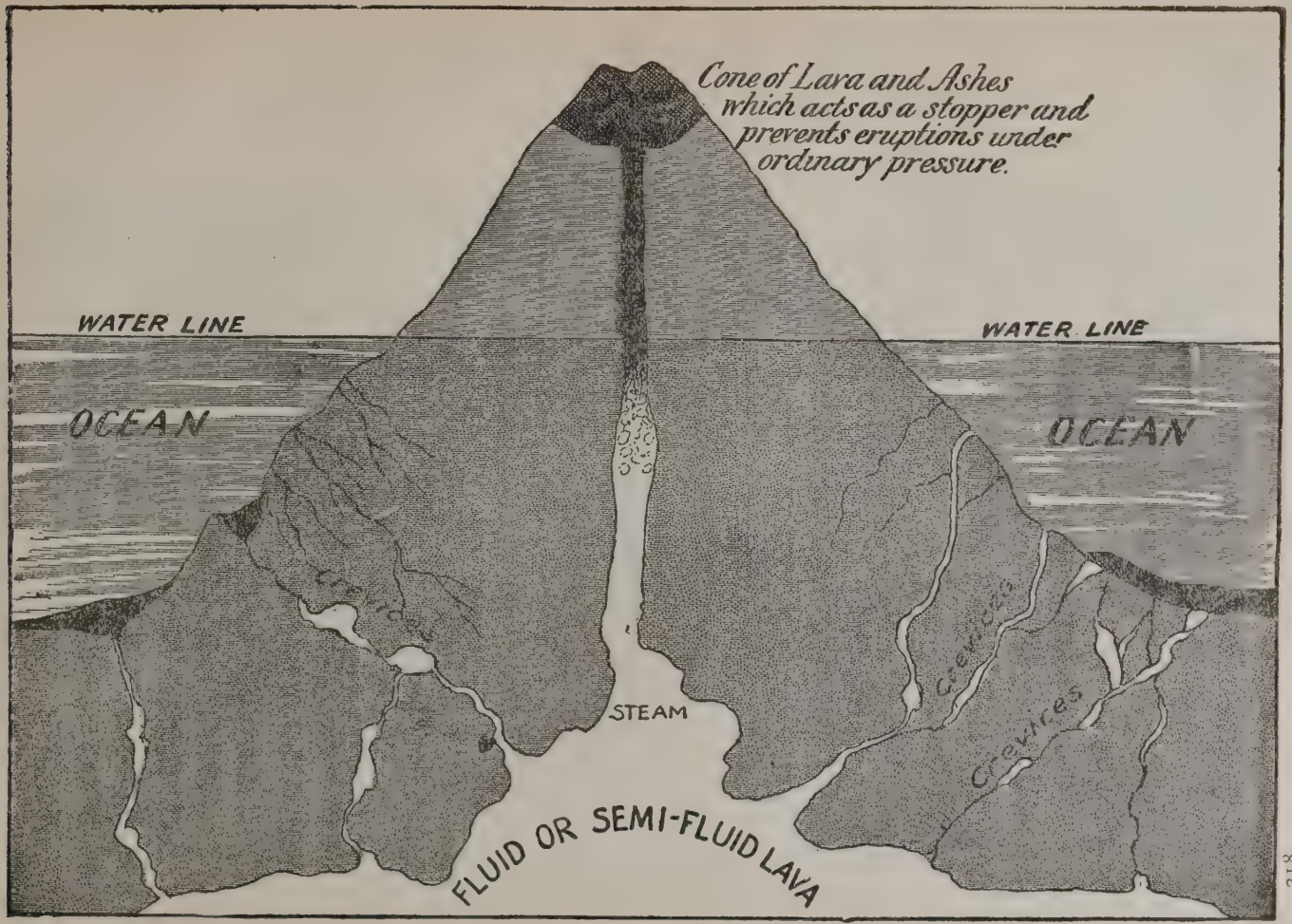
CRATER OF LA SOUFRIERE, ST. VINCENT.
View of west side above the lake. Previous to the eruption of La Soufriere, of St. Vincent, May 8, 1902, there was a lake of clear water at the bottom of the crater which had existed there since the eruption of 1812. The crater brim was about 2,500 feet above the sea.

all parts of the world have very similar curvatures; but older volcanic mountains, in which lava-streams have broken through the cone, secondary cones have arisen, or portions have been blown up, are more irregular in outline and more gradual in inclination.

In size, volcanoes vary from mere mounds a few yards in diameter, such as the *salses* or *mud volcanoes* near the Caspian, to Etna, 10,800 feet high, with a base 30 miles in diameter; Cotopaxi, in the Andes, 18,887 feet high; or Mauna Loa, in the Sandwich Isles, 13,700 feet high, with a base 70 miles in diameter, and two craters, one of which, Kilauea, the largest active crater on our earth, is seven miles in circuit. Larger extinct craters occur in Japan; but all our terrestrial volcanic mountains are dwarfed by those observed on the surface of the moon, which, owing to its smaller size, has cooled more rapidly than our earth. It is, of course, the explosive force from below which keeps the crater clear, as a cup-shaped hollow, truncating the cone; and all stones falling into it would be only thrown out again. It may at the close of an eruption cool down so completely that a lake can form within it, such as Lake Averno, near Naples; or it may long remain a seething sea of lava, such as Kilauea; or the lava may find one or more outlets from it, either by welling over its rim, which it will then generally break down, as in many of the small extinct volcanoes ("puys") of Auvergne, or more usually by bursting through the sides of the cone.

LAVA VARIES VERY MUCH IN LIQUIDITY

It is not generally until the volcano has exhausted its first explosive force that lava begins to issue. Several streams may issue in different directions. Their dimensions are sometimes enormous. Lava varies very much in liquidity and in the rate at which



THIS DIAGRAM SHOWS HOW VOLCANIC ACTION IS CAUSED

A Study of the above Picture will Show how the Molten Mass in the Mountain's Interior Met the Water, and how the Steam Generated thereby, Following the Line of the Least Resistance, Blew off the Top of the Volcano.

it flows. This much depends, however, upon the slope it has to traverse. A lava stream at Vesuvius ran three miles in four minutes, but took three hours to flow the next three miles, while a stream from Mauna Loa ran eighteen miles in two hours. Glowing at first as a white-hot liquid, the lava soon cools at the surface to red and then to black; cinder-like scoriaceous masses form on its surface and in front of the slowly-advancing mass; clouds of steam and other vapor rise from it, and little cones are thrown up from its surface; but many years may elapse before the mass is cooled through. Thus, while the surface is glassy, the interior becomes crystalline.

As to what are the causes of the great convulsions of nature known as the volcano and the earthquake we know very little. Various theories have been advanced, but nothing by any means sure has been discovered, and considerable difference of opinion exists. In truth we know so little concerning the conditions existing in the earth's interior that any views concerning the forces at work there must necessarily be largely conjectural.

Sir Robert S. Ball says, in this connection: "Let us take, for instance, that primary question in terrestrial physics, as to whether the interior of the earth is liquid or solid. If we were to judge merely from the temperatures reasonably believed to exist at a depth of some twenty miles, and if we might overlook the question of pressure, we should certainly say that the earth's interior must be in a fluid state. It seems at least certain that the temperatures to be found at depths of two score miles, and still more at greater depths, must be so high that the most refractory solids, whether metals or minerals, would at once yield if we could subject them to such temperatures in our laboratories. But none of our laboratory experiments can tell us whether, under the pressure of thousands

of tons on the square inch, the application of any heat whatever would be adequate to transform solids into liquids. It may, indeed, be reasonably doubted whether the terms solid and liquid are applicable, in the sense in which we understand them, to the materials forming the interior of the earth.

"A principle, already well known in the arts, is that many, if not all, solids may be made to flow like liquids if only adequate pressure be applied. The making of lead tubes is a well-known practical illustration of this principle, for these tubes are formed simply by forcing solid lead by the hydraulic press through a mould which imparts the desired shape.

"If then a solid can be made to behave like a liquid, even with such pressures as are within our control, how are we to suppose that the solids would behave with such pressures as those to which they are subjected in the interior of the earth? The fact is that the terms solid and liquid, at least as we understand them, appear to have no physical meaning with regard to bodies subjected to these stupendous pressures, and this must be carefully borne in mind when we are discussing the nature of the interior of the earth."

THE VOLCANOE A SAFETY VALVE

Whatever be the state of affairs in the depths of the earth's crust, we may look upon the volcano as a sort of safety-valve, opening a passage for the pent-up forces to the surface, and thus relieving the earth from the terrible effects of the earthquake, through which these imprisoned powers so often make themselves felt. Without the volcanic vent there might be no safety for man on the earth's unquiet face.

Professor J. C. Russell, of Michigan University, presents the following views concerning the status and action of volcanoes :—

"When reduced to its simplest terms, a volcano may be defined as a tube, or conduit, in the earth's crust, through which the molten rock is forced to the surface. The conduit penetrates the cool and rigid rocks forming the superficial portion of the earth, and reaches its highly heated interior.

"The length of volcanic conduits can only be conjectured, but, judging from the approximately known rate of increase of heat with depth (on an average one degree Fahrenheit for each sixty feet), and the temperature at which volcanic rocks melt (from 2,300 to 2,700 degrees Fahrenheit, when not under pressure), they must seemingly have a depth of at least twenty miles. There are other factors to be considered, but in general terms it is safe to assume that the conduits of volcanoes are irregular openings, many miles in depth, which furnish passageways for molten rock (lava) from the highly-heated sub-crust portion of the earth to its surface. . . .

ERUPTIONS OF QUIET TYPE

"During eruptions of the quiet type, the lava comes to the surface in a highly liquid condition—that is, it is thoroughly fused, and flows with almost the freedom of water. It spreads widely, even on a nearly level plain, and may form a comparatively thin sheet several hundred square miles in area, as has been observed in Iceland and Hawaii. On the Snake River plains, in Southern Idaho, there are sheets of once molten rock which were poured out in the manner just stated, some four hundred square miles in area and not over seventy-five feet in average thickness. When an eruption of highly liquid lava occurs in a mountainous region, the molten rock may cascade down deep slopes and flow through narrow valleys for fifty miles or more before becoming chilled sufficiently to arrest its progress. Instances are abundant where quiet eruptions have

occurred in the midst of a plain, and built up 'lava cones,' or low mounds, with immensely expanded bases. Illustrations are furnished in Southern Idaho, in which the cones formed are only three hundred or four hundred feet high, but have a breadth at the base of eight or ten miles. In the class of eruption illustrated by these examples, there is an absence of fragmental material, such as explosive volcanoes hurl into the air, and a person may stand within a few yards of a rushing stream of molten rock, or examine closely the opening from which it is being poured out, without danger or serious inconvenience.

"The quiet volcanic eruptions are attended by the escape of steam or gases from the molten rock, but the lava being in a highly liquid state, the steam and gases dissolved in it escape quietly and without explosions. If, however, the molten rock is less completely fluid, or in a viscous condition, the vapors and gases contained in it find difficulty in escaping, and may be retained until, becoming concentrated in large volume, they break their way to the surface, producing violent explosions. Volcanoes in which the lava extruded is viscous, and the escape of steam and gases is retarded until the pent-up energy bursts all bounds, are of the explosive type. One characteristic example is Vesuvius.

"When steam escapes from the summit of a volcanic conduit—which, in plain terms, is a tall vessel filled with intensely hot and more or less viscous liquid—masses of the liquid rock are blown into the air, and on falling build up a rim or crater about the place of discharge. Commonly the lava in the summit portion of a conduit becomes chilled and perhaps hardened, and when a steam explosion occurs this crust is shattered and the fragments hurled into the air and contributed to the building of the walls of the inclosing crater.

"The solid rock blown out by volcanoes consists usually of highly vesicular material which hardened on the surface of the column of lava within a conduit and was shattered by explosions beneath it. These fragments vary in size from dust particles up to masses several feet in diameter, and during violent eruptions are hurled miles high. The larger fragments commonly fall near their place of origin, and usually furnish the principal part of the material of which craters are built, but the gravel-like kernels, lapilli, may be carried laterally several miles if a wind is blowing, while the dust is frequently showered down on thousands of square miles of land and sea. The solid and usually angular fragments manufactured in this manner vary in temperature, and may still be red hot on falling.

"Volcanoes of the explosive type not uncommonly discharge streams of lava, which may flow many miles. In certain instances these outwellings of liquid rock occur after severe earthquakes and violent explosions, and may have all the characteristics of quiet eruptions. There is thus no fundamental difference between the two types into which it is convenient to divide volcanoes.

MOUNTAINS BLOW THEIR HEADS OFF

"In extreme examples of explosive volcanoes, the summit portion of a crater, perhaps several miles in circumference and several thousand feet high, is blown away. Such an occurrence is recorded in the case of the volcano Coseguina, Nicaragua, in 1835. Or, an entire mountain may disappear, being reduced to lapilli and dust and blown into the air, as in the case of Krakatoa, in the Straits of Sunda, in 1883.

"The essential feature of a volcano, as stated above, is a tube or conduit, leading from the highly heated sub-crust portion of the

earth to the crater and through which molten rock is forced upward to the surface. The most marked variations in the process depend on the quantity of molten rock extruded, and on the freedom of escape of the steam and gases contained in the lava.

"The cause of the rise of the molten rock in a volcano is still a matter for discussion. Certain geologists contend that steam is the sole motive power; while others consider that the lava is forced to the surface owing to pressure on the reservoir from which it comes. The view perhaps most favorably entertained at present, in reference to the general nature of volcanic eruptions, is that the rigid outer portion of the earth becomes fractured, owing principally to movements resulting from the shrinking of the cooling inner mass, and that the intensely hot material reached by the fissures, previously solid owing to pressure, becomes liquid when pressure is relieved, and is forced to the surface. As the molten material rises it invades the water-charged rocks near the surface and acquires steam, or the gases resulting from the decomposition of water, and a new force is added which produces the most conspicuous and at times the most terrible phenomena accompanying eruptions."

The active agency of water is strongly maintained by many geologists, and certainly gains support from the vast clouds of steam given off by volcanoes in eruption and the steady and quiet emission of steam from many in a state of rest. The quantities of water in the liquid state, to which is due the frequent enormous outflows of mud, leads to the same conclusion. Many scientists, indeed, while admitting the agency of water, look upon this as the aqueous material originally pent up within the rocks. For instance Professor Shaler, dean of the Lawrence Scientific School, says:

"Volcanic outbreaks are merely the explosion of steam under high pressure, steam which is bound in rocks buried underneath

the surface of the earth and there subjected to such tremendous heat that when the conditions are right its pent-up energy breaks forth and it shatters its stone prison walls into dust. The process by which the water becomes buried in this manner is a long one. Some contend that it leaks down from the surface of the earth through fissures in the outer crust, but this theory is not generally accepted. The common belief is that water enters the rocks during the crystalization period, and that these rocks through the natural action of rivers and streams become deposited in the bottom of the ocean. Here they lie for many ages, becoming buried deeper and deeper under masses of like sediment, which are constantly being washed down upon them from above. This process is called the blanketing process.

"Each additional layer of sediment, while not raising the level of the sea bottom, buries the first layers just so much the deeper and adds to their temperature just as does the laying of extra blankets on a bed. When the first layer has reached a depth of a few thousand feet the rocks which contain the water of crystalization are subjected to a terrific heat. This heat generates steam, which is held in a state of frightful tension in its rocky prison. Wrinklings in the outer crust of the earth's surface occur, caused by the constant shrinking of the earth itself and by the contraction of the outer surface as it settles on the plastic centers underneath. Fissures are caused by these foldings, and as these fissures reach down into the earth the pressure is removed from the rocks and the compressed steam in them, being released, explodes with tremendous force."

This view is, very probably, applicable to many cases, and the exceedingly fine dust which so often rises from volcanoes has, doubtless, for one of its causes the sudden and explosive conversion

of water into steam in the interior of ejected lava, thus rending it into innumerable fragments. But that this is the sole mode of action of water in volcanic eruptions is very questionable. It certainly does not agree with the immense volumes at times thrown out, while explosions of such extreme intensity as that of Krakatoa very strongly lead to the conclusion that a great mass of water has made its way through newly opened fissures to the level of molten rock, and exploded into steam with a suddenness which gave it the rending force of dynamite or the other powerful chemical explosives.

As the earthquake is so intimately associated with the volcano the causes of the latter are in great measure the causes of the former, and the forces at work frequently produce a more or less violent quaking of the earth's surface before they succeed in opening a channel of escape through the mountain's heart. One agency of great potency, and one whose work never ceases, has doubtless much to do with earthquake action. In the description of this we cannot do better than to quote from "The Earth's Beginning" of Sir Robert S. Ball.

CAUSE OF EARTHQUAKES

"As to the immediate cause of earthquakes there is no doubt considerable difference of opinion. But I think it will not be doubted that an earthquake is one of the consequences, though perhaps a remote one, of the gradual loss of internal heat from the earth. As this terrestrial heat is gradually declining, it follows from the law that we have already so often had occasion to use that the bulk of the earth must be shrinking. No doubt the diminution in the earth's diameter due to the loss of heat must be exceedingly small, even in a long period of time. The cause, however, is continually in operation, and, accordingly, the crust of the earth has from time to time to be accommodated to the fact that

the whole globe is lessening. The circumference of our earth at the equator must be gradually declining; a certain length in that circumference is lost each year. We may admit that loss to be a quantity far too small to be measured by any observations as yet obtainable, but, nevertheless, it is productive of phenomena so important that it cannot be overlooked.

"It follows from these considerations that the rocks which form the earth's crust over the surface of the continents and the

EARTHQUAKE AT MESSINA, 1783.

islands, or beneath the bed of the ocean, must have a lessening acreage year by year. These rocks must therefore submit to compression, either continuously or from time to time, and the necessary yielding of the rocks will in general take place in those regions where the materials of the earth's crust happen to have comparatively small powers of resistance. The acts of compression will often

and perhaps generally, not proceed with uniformity, but rather with small successive shifts, and even though the displacements of the rocks in these shifts be actually very small, yet the pressures to which the rocks are subjected are so vast that a very small shift may correspond to a very great terrestrial disturbance.

"Suppose, for instance, that there is a slight shift in the rocks on each side of a crack, or fault, at a depth of ten miles. It must be remembered that the pressure ten miles down would be about thirty-five tons to the square inch. Even a slight displacement of one extensive surface over another, the sides being pressed together with a force of thirty-five tons on the square inch, would be an operation necessarily accompanied by violence greatly exceeding that which we might expect from so small a displacement if the forces concerned had been of more ordinary magnitude. On account of this great multiplication of the intensity of the phenomenon, merely a small rearrangement of the rocks in the crust of the earth, in pursuance of the necessary work of accommodating its volume to the perpetual shrinkage, might produce an excessively violent shock, extending far and wide. The effect of such a shock would be propagated in the form of waves through the globe, just as a violent blow given at one end of a bar of iron by a hammer is propagated through the bar in the form of waves. When the effect of this internal adjustment reaches the earth's surface it will sometimes be great enough to be perceptible in the shaking it gives that surface. The shaking may be so violent that buildings may not be able to withstand it. Such is the phenomenon of an earthquake.

"When the earth is shaken by one of those occasional adjustments of the crust which I have described, the wave that spreads like a pulsation from the centre of agitation extends all over our

globe and is transmitted right through it. At the surface lying immediately over the centre of disturbance there will be a violent shock. In the surrounding country, and often over great distances, the earthquake may also be powerful enough to produce destructive effects. The convulsion may also be manifested over a far larger area of country in a way which makes the shock to be felt, though the damage wrought may not be appreciable. But beyond a limited distance from the centre of the agitation the earthquake will produce no destructive effects upon buildings, and will not even cause vibrations that would be appreciable to ordinary observation.

THE RADIUS OF DISTURBANCE.

"In each locality in which earthquakes are chronic it would seem as if there must be a particularly weak spot in the earth some miles below the surface. A shrinkage of the earth, in the course of the incessant adjustment between the interior and the exterior, will take place by occasional little jumps at this particular centre. The fact that there is this weak spot at which small adjustments are possible may provide, as it were, a safety-valve for other places in the same part of the world. Instead of a general shrinking, the materials would be sufficiently elastic and flexible to allow the shrinking for a very large area to be done at this particular locality. In this way we may explain the fact that immense tracts on the earth are practically free from earthquakes of a serious character, while in the less fortunate regions the earthquakes are more or less perennial.

"Now, suppose an earthquake takes place in Japan, it originates a series of vibrations through our globe. We must here distinguish between the rocks—I might almost say the comparatively pliant rocks—which form the earth's crust, and those which form

the intensely rigid core of the interior of our globe. The vibrations which carry the tidings of the earthquake spread through the rocks on the surface, from the centre of the disturbance, in gradually enlarging circles. We may liken the spread of these vibrations to the ripples in a pool of water which diverge from the spot where a raindrop has fallen. The vibrations transmitted by the rocks on the surface, or on the floor of the ocean, will carry the message all over the earth. As these rocks are flexible, at all events by comparison with the earth's interior, the vibrations will be correspondingly large, and will travel with vigor over land and under sea. In due time they reach, say the Isle of Wight, where they set the pencil of the seismometer at work. But there are different ways round the earth from Japan to the Isle of Wight, the most direct route being across Asia and Europe; the other route across the Pacific, America, and the Atlantic. The vibrations will travel by both routes, and the former is the shorter of the two."

TRANSMISSIONS OF VIBRATIONS

Some brief repetition may not here be amiss as to the products of volcanic action, of which so much has been said in the preceding pages, especially as many of the terms are to some extent technical in character. The most abundant of these substances is steam or water-gas, which, as we have seen, issues in prodigious quantities during every eruption. But with the steam a great number of other volatile materials frequently make their appearance. Though we have named a number of these at the beginning of this chapter, it will not be out of order to repeat them here. The chief among these are the acid gases known as hydrochloric acid, sulphurous acid, sulphuretted hydrogen, carbonic acid, and boracic acid; and with these acid gases there issue hydrogen, nitrogen

ammonia, the volatile metals arsenic, antimony, and mercury, and some other substances. These volatile substances react upon one another, and many new compounds are thus formed. By the action of sulphurous acid and sulphuretted hydrogen on each other, the sulphur so common in volcanic districts is separated and deposited. The hydrochloric acid acts very energetically on the rocks around the vents, uniting with the iron in them to form the yellow ferric-chloride, which often coats the rocks round the vent and is usually mistaken by casual observers for sulphur.

Some of the substances emitted by volcanic vents, such as hydrogen and sulphuretted hydrogen, are inflammable, and when they issue at a high temperature these gases burst into flame the moment that they come into contact with the air. Hence, when volcanic fissures are watched at night, faint lambent flames are frequently seen playing over them, and sometimes these flames are brilliantly colored, through the presence of small quantities of certain metallic oxides. Such volcanic flames, however, are scarcely ever strongly luminous, and the red, glowing light which is observed over volcanic mountains in eruption is due to quite another cause. What is usually taken for flame during a volcanic eruption is simply, as we have before stated, the glowing light of the surface of a mass of red-hot lava reflected from the cloud of vapor and dust in the air, much as the lights of a city are reflected from the water vapor of the atmosphere during a night of fog.

Besides the volatile substances which issue from volcanic vents, mingling with the atmosphere or condensing upon their sides, there are many solid materials ejected, and these may accumulate around the orifices till they build up mountains of vast dimensions, like Etna, Teneriffe, and Chimborazo. Some of these solid materials are evidently fragments of the rock-masses, through which the

volcanic fissure has been rent; these fragments have been carried upwards by the force of the steam-blast and scattered over the sides of the volcano. But the principal portion of the solid materials ejected from volcanic orifices consists of matter which has been extruded from sources far beneath the surface, in highly-heated and fluid or semi-fluid condition.

It is to these materials that the name of "lavas" is properly applied. Lavas present a general resemblance to the slags and clinkers which are formed in our furnaces and brick-kilns, and consist, like them, of various stony substances which have been more or less perfectly fused. When we come to study the chemical composition and the microscopical structure of lavas, however, we shall find that there are many respects in which they differ entirely from these artificial products, they consisting chiefly of felspar, or of this substance in association with augite or hornblende. In texture they may be stony, glassy, resin-like, vesicular or cellular and light in weight, as in the case of pumice or scoria.

FLOATING PUMICE

The steam and other gases rising through liquid lava are apt to produce bubbles, yielding a surface froth or foam. This froth varies greatly in character according to the nature of the material from which it is formed. In the majority of cases the lavas consist of a mass of crystals floating in a liquid magma, and the distension of such a mass by the escape of steam from its midst gives rise to the formation of the rough cindery-looking material to which the name of "scoria" is applied. But when the lava contains no ready-formed crystals, but consists entirely of a glassy substance in a more or less perfect state of fusion, the liberation of steam gives rise to the formation of the beautiful material known as "pumice."

Pumice consists of a mass of minute glass bubbles; these bubbles do not usually, however, retain their globular form, but are elongated in one direction through the movement of the mass while it is still in a plastic state. The quantity of this substance ejected is often enormous. We have seen to what a vast extent it was thrown out from the crater of Krakatoa. During the year 1878, masses of floating pumice were reported as existing in the vicinity of the Solomon Isles, and covering the surface of the sea to such extent that it took ships three days to force their way through them. Sometimes this substance accumulates in such quantities along coasts that it is difficult to determine the position of the shore within a mile or two, as we may land and walk about on the great floating raft of pumice. Recent deep-sea soundings, carried on in the *Challenger* and other vessels, have shown that the bottom of the deepest portion of the ocean, far away from the land, is covered with volcanic materials which have been carried through the air or have floated on the surface of the ocean.

Fragments of scoria or pumice may be thrown hundreds or thousands of feet into the atmosphere, those that fall into the crater and are flung up again being gradually reduced in size by friction. Thus it is related by Mr. Poulett Scrope, who watched the Vesuvian eruption of 1822, which lasted for nearly a month, that during the earlier stages of the outburst fragments of enormous size were thrown out of the crater, but by constant re-ejection these were gradually reduced in size, till at last only the most impalpable dust issued from the vent. This dust filled the atmosphere, producing in the city of Naples "a darkness that might be felt." So excessively finely divided was it, that it penetrated into all drawers, boxes, and the most closely fastened receptacles, filling them completely. The fragmentary materials ejected from volcanoes are

often given the name of cinders or ashes. These, however, are terms of convenience only, and do not properly describe the volcanic material.

Sometimes the passages of steam through a mass of molten glass produces large quantities of a material resembling spun glass. Small particles of this glass are carried into the air and leave behind them thin, glassy filaments like a tail. At the volcano of Kilauea in Hawaii, this substance, as previously stated, is abundantly produced, and is known as 'Pele's Hair'—Pele being the name of the goddess of the mountain. Birds' nests are sometimes found composed of this beautiful material. In recent years an artificial substance similar to this Pele's hair has been extensively manufactured by passing jets of steam through the molten slag of iron-furnaces; it resembles cotton-wool, but is made up of fine threads of glass, and is employed for the packing of boilers and other purposes.

The lava itself, as left in huge deposits upon the surface, assumes various forms, some crystalline, others glassy. The latter is usually found in the condition known as obsidian, ordinarily black in color, and containing few or no crystals. It is brittle, and splits into sharp-edged or pointed fragments, which were used by primitive peoples for arrow-heads, knives and other cutting implements. The ancient Mexicans used bits of it for shaving purposes, it having an edge of razor-like sharpness. They also used it as the cutting part of their weapons of war.

CHAPTER XXI.

The Active Volcanoes of the Earth.

IT is not by any means an easy task to frame an estimate of the number of volcanoes in the world. Volcanoes vary greatly in their dimensions, from vast mountain masses, rising to a height of nearly 25,000 feet above sea-level, to mere molehills. They likewise exhibit every possible stage of development and decay: while some are in a state of chronic active eruption, others are reduced to the condition of *solfataras*, or vents emitting acid vapors, and others again have fallen into a more or less complete state of ruin through the action of denuding forces.

NUMBER OF ACTIVE VOLCANOES

Even if we confine our attention to the larger volcanoes, which merit the name of mountains, and such of these as we have reason to believe to be in a still active condition, our difficulties will be diminished, but not by any means removed. Volcanoes may sink into a dormant condition that at times endures for hundreds or even thousands of years, and then burst forth into a state of renewed activity; and it is quite impossible, in many cases, to distinguish between the conditions of dormancy and extinction.

We shall, however, probably be within the limits of truth in stating that the number of great habitual volcanic vents upon the globe which we have reason to believe are still in active condition, is somewhere between 300 and 350. Most of these are marked by more or less considerable mountains, composed of the materials

ejected from them. But if we include mountains which exhibit the external conical form, crater-like hollows, and other features of volcanoes, yet concerning the activity of which we have no record or tradition, the number will fall little, if anything, short of 1,000.

The mountains composed of volcanic materials, but which have lost through denudation the external form of volcanoes, are still more numerous, and the smaller temporary openings which are usually subordinate to the habitual vents that have been active during the periods covered by history and tradition, must be numbered by thousands. There are still feebler manifestations of the volcanic forces—such as steam-jets, geysers, thermal and mineral waters, spouting saline and muddy springs, and mud volcanoes—that may be reckoned by millions. It is not improbable that these less powerful manifestations of the volcanic forces to a great extent make up in number what they want in individual energy; and the relief which they afford to the imprisoned activities within the earth's crust may be almost equal to that which results from the occasional outbursts at the great habitual volcanic vents.

In taking a general survey of the volcanic phenomena of the globe, no facts come out more strikingly than that of the very unequal distribution, both of the great volcanoes, and of the minor exhibitions of subterranean energy.

Thus, on the whole of the continent of Europe, there is but one habitual volcanic vent—that of Vesuvius—and this is situated upon the shores of the Mediterranean. In the islands of that sea, however there are no less than six volcanoes: namely, Stromboli, and Vulcano, in the Lipari Islands; Etna, in Sicily; Graham's Isle, a submarine volcano, off the Sicilian coast; and Santorin and Nisyros, in the Ægean Sea.

The African continent is at present known to contain about ten active volcanoes—four on the west coast, and six on the east coast, while about ten other active volcanoes occur on islands close to the African coasts. On the continent of Asia, more than twenty active volcanoes are known or believed to exist, but no less than twelve of these are situated in the peninsula of Kamchatka. No volcanoes are known to exist in the Australian continent.

The American continent contains a greater number of volcanoes than the continents of the Old World. There are twenty in North America, twenty-five in Central America, and thirty-seven in South America. Thus, taken altogether, there are about one hundred and seventeen volcanoes situated on the great continental lands of the globe, while nearly twice as many occur upon the islands scattered over the various oceans.

ASIATIC INLAND VOLCANOES

Upon examining further into the distribution of the continental volcanoes, another very interesting fact presents itself. The volcanoes are in almost every instance situated either close to the coasts of the continent, or at no great distance from them. There are, indeed, only two exceptions to this rule. In the great and almost wholly unexplored table-land lying between Siberia and Tibet four volcanoes are said to exist, and in the Chinese province of Manchuria several others. More reliable information is, however, needed concerning these volcanoes.

It is a remarkable circumstance that all the oceanic islands which are not coral-reefs are composed of volcanic rocks; and many of these oceanic islands, as well as others lying near the shores of the continents, contain active volcanoes.

Through the midst of the Atlantic Ocean runs a ridge, which, by the soundings of the various exploring vessels sent out in recent

years, has been shown to divide the ocean longitudinally into two basins. Upon this great ridge, and the spurs proceeding from it, rise numerous mountainous masses, which constitute the well-known Atlantic islands and groups of islands. All of these are of volcanic origin, and among them are numerous active volcanoes. The Island of Jan Mayen contains an active volcano, and Iceland contains thirteen, and not improbably more; the Azores have six active volcanoes, the Canaries three; while about eight volcanoes lie off the west coast of Africa. In the West Indies there are six active volcanoes; and three submarine volcanoes have been recorded within the limits of the Atlantic Ocean. Altogether, no less than forty active volcanoes are situated upon the great submarine ridges which traverse the Atlantic longitudinally.

But along the same line the number of extinct volcanoes is far greater, and there are not wanting proofs that the volcanoes which are still active are approaching the condition of extinction.

VOLCANOES OF THE PACIFIC

If the great medial chain of the Atlantic presents us with an example of a chain of volcanic mountains verging on extinction, we have in the line of islands separating the Pacific and Indian Oceans an example of a similar range of volcanic vents which are in a condition of the greatest activity. In the peninsula of Kamchatka there are twelve active volcanoes, in the Aleutian Islands thirty-one, and in the peninsula of Alaska three. The chain of the Kuriles contains at least ten active volcanoes; the Japanese Islands and the islands to the south of Japan twenty-five. The great group of islands lying to the south-east of the Asiatic continent is at the present time the grandest focus of volcanic activity upon the globe. No less than fifty active volcanoes occur here.

Farther south, the same chain is probably continued by the four active volcanoes of New Guinea, one or more submarine volcanoes, and several vents in New Britain, the Solomon Isles, and the New Hebrides, the three active volcanoes of New Zealand, and possibly by Mount Erebus and Mount Terror in the Antarctic region. Altogether, no less than 150 active volcanoes exist in the

MOUNT EREBUS.

Two volcanoes exist in the frozen seas of the Antarctic zone, Mount Erebus and Mount Terror, whose smoking summits indicate a strange conjunction of the forces of fire and frost.

chain of islands which stretch from Behring's Straits down to the Antarctic circle; and if we include the volcanoes on Indian and Pacific Islands which appear to be situated on lines branching from this particular band, we shall not be wrong in the assertion that this great system of volcanic mountains includes at least one half of the habitually active vents of the globe. In addition to the active vents, there are here several hundred very perfect volcanic

cones, many of which appear to have recently become extinct, though some of them may be merely dormant, biding their time.

A third series of volcanoes starts from the neighborhood of Behring's Straits, and stretches along the whole western coast of the American continent. This is much less continuous, but nevertheless very important, and contains, with its branches, nearly a hundred active volcanoes. On the north this great band is almost united with the one we have already described by the chain of the Aleutian and Alaska volcanoes. In British Columbia about the parallel of 60° N. there exist a number of volcanic mountains, one of which, Mount St. Elias, is believed to be 18,000 feet in height. Farther south, in the territory of the United States, a number of grand volcanic mountains exist, some of which are probably still active, for geysers and other manifestations of volcanic activity abound. From the southern extremity of the peninsula of California an almost continuous chain of volcanoes stretches through Mexico and Gautemala, and from this part of the volcanic band a branch is given off which passes through the West Indies, and contains the volcanoes which have so recently given evidence of their vital activity.

In South America the line is continued by the active volcanoes of Ecuador, Bolivia and Chili, but at many intermediate points in the chain of the Andes extinct volcanoes occur, which to a great extent fill up the gaps in the series. A small offshoot to the westward passes through the Galapagos Islands. The great band of volcanoes which stretches through the American continent is second only in importance, and in the activity of its vents, to the band which divides the Pacific from the Indian Ocean.

The third volcanic band of the globe is that, already spoken of, which traverses the Atlantic Ocean from north to south. This

series of volcanic mountains is much more broken and interrupted than the other two, and a greater proportion of its vents are extinct. It attained its condition of maximum activity during the distant period of the Miocene, and now appears to be passing into a state of gradual extinction.

Beginning in the north with the volcanic rocks of Greenland and Bear Island, we pass southwards, by way of Jan Mayen, Ice

MOUNT HECLA—ICELAND.
One of the two most famous of the great Icelandic volcanoes.

land and the Faroe Islands, to the Hebrides and the north of Ireland. Thence, by way of the Azores, the Canaries and the Cape de Verde Islands, with some active vents, we pass to the ruined volcanoes of St. Paul, Fernando de Noronha, Ascension, St. Helena, Trinidad and Tristan da Cunha. From this great Atlantic band two branches proceed to the eastward, one through Central Europe, where all the vents are now extinct, and the other through

the Mediterranean to Asia Minor, the great majority of the volcanoes along the latter line being now extinct, though a few are still active. The volcanoes on the eastern coast of Africa may be regarded as situated on another branch from this Atlantic volcanic band. The number of active volcanoes on this Atlantic band and its branches, exclusive of those in the West Indies, does not exceed fifty.

THIAN SHAN AND HAWAIIAN VOLCANOES

From what has been said, it will be seen that the volcanoes of the globe not only usually assume a linear arrangement, but nearly the whole of them can be shown to be thrown up along three well-marked bands and the branches proceeding from them. The first and most important of these bands is nearly 10,000 miles in length, and with its branches contains more than 150 active volcanoes; the second is 8,000 miles in length, and includes about 100 active volcanoes; the third is much more broken and interrupted, extends to a length of nearly 1,000 miles, and contains about 50 active vents. The volcanoes of the eastern coast of Africa, with Mauritius, Bourbon, Rodriguez, and the vents along the line of the Red Sea, may be regarded as forming a fourth and subordinate band.

Thus we see that the surface of the globe is covered by a network of volcanic bands, all of which traverse it in sinuous lines with a general north-and-south direction, giving off branches which often run for hundreds of miles, and sometimes appear to form a connection between the great bands.

To this rule of the linear arrangement of the volcanic vents of the globe, and their accumulation along certain well-marked bands, there are two very striking exceptions, which we must now proceed to notice.

In the very centre of the continent formed by Europe and Asia, the largest unbroken land-mass of the globe, there rises from the great central plateau the remarkable volcanoes of the Thian Shan Range. The existence of these volcanoes, of which only obscure traditional accounts had reached Europe before the year 1858, appears to be completely established by the researches of recent Russian and Swedish travelers. Three volcanic vents appear to exist in this region, and other volcanic phenomena have been stated to occur in the great plateau of Central Asia, but the existence of the latter appears to rest on very doubtful evidence. The only accounts which we have of the eruptions of these Thian Shan volcanoes are contained in Chinese histories and treatises on geography.

The second exceptionally situated volcanic group is that of the Hawaiian Islands. While the Thian Shan volcanoes rise in the centre of the largest unbroken land-mass, and stand on the edge of the loftiest and greatest plateau in the world, the volcanoes of the Hawaiian Islands rise in the northern centre of the largest ocean and from almost the greatest depths in that ocean. All round the Hawaiian Islands the sea has a depth of from 2,000 to 3,000 fathoms, and the island-group culminates in several volcanic cones, which rise to the height of nearly 14,000 feet above the sea-level. The volcanoes of the Hawaiian Islands are unsurpassed in height and bulk by those of any other part of the globe.

With the exception of the two isolated groups of the Thian Shan and the Hawaiian Islands, nearly all the active volcanoes of the globe are situated near the limits which separate the great land-and-water-masses of the globe—that is to say, they occur either on the parts of continents not far removed from their coast-lines, or on islands in the ocean not very far distant from the shores. The

fact of the general proximity of volcanoes to the sea is one which has frequently been pointed out by geographers, and may now be regarded as being thoroughly established.

VOLCANOES PARALLEL TO MOUNTAIN CHAINS

Many of the grandest mountain-chains have bands of volcanoes lying parallel to them. This is strikingly exhibited by the great mountain-masses which lie on the western side of the American continent. The Rocky Mountains and the Andes consist of folded and crumpled masses of altered strata which, by the action of denuding forces, have been carved into series of ridges and summits. At many points, however, along the sides of these great chains we find that fissures have been opened and lines of volcanoes formed, from which enormous quantities of lava have flowed and covered great tracts of country.

This is especially marked in the Snake River plain of Idaho, in the western United States. In this, and the adjoining regions of Oregon and Washington, an enormous tract of country has been overflowed by lava in a late geological period, the surface covered being estimated to have a larger area than France and Great Britain combined. The Snake River cuts through it in a series of picturesque gorges and rapids, enabling us to estimate its thickness, which is considered to average 4000 feet. Looked at from any point on its surface, one of these lava-plains appears as a vast level surface, like that of a lake bottom. This uniformity has been produced either by the lava rolling over a plain or lake bottom, or by the complete effacement of an original, undulating contour of the ground under hundreds or thousands of feet of lava in successive sheets. The lava, rolling up to the base of the mountains, has followed the sinuosities of their margin, as the waters of a lake

follow its promontories and bays. Similar conditions exist along the Sierra Nevada range of California, and to some extent placer mining has gone on under immense beds of lava, by a process of tunneling beneath the volcanic rock.

In some localities the volcanoes are of such height and dimensions as to overlook and dwarf the mountain-ranges by the side of which they lie. Some of the volcanoes lying parallel to the great American axis appear to be quite extinct, while others are in full activity. In the Eastern continent we find still more striking examples of parallelism between great mountain-chains and the lands along which volcanic activity is exhibited—volcanoes, active or extinct, following the line of the great east and west chains which extend through southern Europe and Asia. There are some other volcanic bands which exhibit a similar parallelism with mountain chains; but, on the other hand, there are volcanoes between which and the nearest mountain-axis no such connection can be traced.

AREAS OF UPHEAVAL AND SUBSIDENCE

There is one other fact concerning the mode of distribution of volcanoes upon the surface of the globe, to which we must allude. By a study of the evidences presented by coral-reefs, raised beaches, submerged forests, and other phenomena of a similar kind, it can be shown that certain wide areas of the land and of the ocean-floor are at the present time in a state of subsidence, while other equally large areas are being upheaved. And the observations of the geologist prove that similar upward and downward movements of portions of the earth's crust have been going on through all geological times.

Now, as Mr. Darwin has so well shown in his work on "Coral-Reefs," if we trace upon a map the areas of the earth's surface

which are undergoing upheaval and subsidence respectively, we shall find that nearly all the active volcanoes of the globe are situated upon rising areas, and that volcanic phenomena are conspicuously absent from those parts of the earth's crust which can be proved at the present day to be undergoing depression.

The remarkable linear arrangement of volcanic vents has a significance that is well worthy of fuller consideration. There are facts known which point to the cause of this state of affairs. It is not uncommon for small cones of scoriæ to be seen following lines on the flanks or at the base of a great volcanic mountain. These are undoubtedly lines of fissure, caused by the subterranean forces. In fact, such fissures have been seen opening on the sides of Mount Etna, in whose bottom could be seen the glowing lava. Along these fissures, in a few days, scoriæ cones appeared; on one occasion no less than thirty-six in number.

It is believed by geologists that the linear systems of volcanoes are ranged along similar lines of fissure in the earth's crust—enormous breaks, extending for thousands of miles, and the result of internal energies acting through vast periods of time. Along these immense fissures in the earth's rock-crust there appear, in place of small scoriæ cones, great volcanoes, built up through the ages by a series of powerful eruptions, and only ceasing to spout fire themselves when the portion of the great crack upon which they lie is closed. The greatest of these fissures is that along the vast sinuous band of volcanoes extending from near the Arctic circle at Behring's Straits to the Antarctic circle at South Victoria Land, not far from half round the earth. It doubtless marks the line of mighty forces which have been active for millions of years.

CHAPTER XXII.

The Famous Vesuvius and the Destruction of Pompeii and Herculaneum.

THE famous volcano of southern Italy named Vesuvius, which is now so constantly in eruption, was described by the ancients as a cone-shaped mountain with a flat top, on which was a deep circular valley filled with vines and grass, and surrounded by high precipices. A large population lived on the sides of the mountain, which was covered with beautiful woods, and there were fine flourishing cities at its foot. So little was the terrible nature of the valley on the top understood, that in A. D. 72, Spartacus, a rebellious Roman gladiator, encamped there with some thousands of fighting men, and the Roman soldiers were let down the precipices in order to surprise and capture them.

There had been earthquakes around the mountain, and one of the cities had been nearly destroyed; but no one was prepared for what occured seven years after the defeat of Spartacus. Suddenly, in the year 79 A. D., a terrific rush of smoke, steam, and fire belched from the mountain's summit; one side of the valley in which Spartacus had encamped was blown off, and its rocks, with vast quantities of ashes, burning stones, and sand, were ejected far into the sky. They then spread out like a vast pall, and fell far and wide. For eight days and nights this went on, and the enormous quantity of steam sent up, together with the deluge of rain that fell, produced torrents on the mountain-side, which, carrying

onward the fallen ashes, overwhelmed everything in their way. Sulphurous vapors filled the air and violent tremblings of the earth were constant.

A city six miles off was speedily rendered uninhabitable, and was destroyed by the falling stones; but two others—Herculaneum and Pompeii—which already had suffered from the down-pour of ashes, were gradually filled with a flood of water, sand, and ashes, which came down the side of the volcano, and covering them entirely.

BURIED CITIES EXCAVATED.

The difference in ease of excavation is due to the following circumstance. Herculaneum being several miles nearer the crater, was buried in a far more consistent substance, seemingly composed of volcanic ashes cemented by mud; Pompeii, on the contrary, was buried only in ashes and loose stones. The casts of statues found in Herculaneum show the plastic character of the material that fell there, which time has hardened to rock-like consistency.

These statues represented Hercules and Cleopatra, and the theatre proved to be that of the long-lost city of Herculaneum. The site of Pompeii was not discovered until forty years afterward, but work there proved far easier than at Herculaneum, and more progress was made in bringing it back to the light of day.

The less solid covering of Pompeii has greatly facilitated the work of excavation, and a great part of the city has been laid bare. Many of its public buildings and private residences are now visible, and some whole streets have been cleared, while a multitude of interesting relics have been found. Among those are casts of many of the inhabitants, obtained by pouring liquid plaster into the ash moulds that remained of them. We see them to-day in the attitude and with the expression of agony and horror with which death met them more than eighteen centuries ago.

In succeeding eruptions much lava was poured out; and in A. D. 472, ashes were cast over a great part of Europe, so that much fear was caused at Constantinople. The buried cities were more and more covered up, and it was not until about A. D. 1700 that, as above stated, the city of Herculaneum was discovered, the peasants of the vicinity being in the habit of extracting marble from its ruins. They had also, in the course of years, found many statues. In consequence, an excavation was ordered by Charles III, the earliest result being the discovery of the theatre, with the statues above named. The work of excavation, however, has not progressed far in this city, on account of its extreme difficulty, though various excellent specimens of art-work have been discovered, including the finest examples of mural painting extant from antiquity. The library was also discovered, 1803 papyri being found. Though these had been charred to cinder, and were very difficult to unroll and decipher, over 300 of them have been read.

PLINY'S CELEBRATED DESCRIPTION

Pliny the Younger, to whom we are indebted for the only contemporary account of the great eruption under consideration, was at the time of its occurrence resident with his mother at Misenum, where the Roman fleet lay, under the command of his uncle, the great author of the "Historia Naturalis". His account, contained in two letters to Tacitus (*lib. vi. 16, 20*), is not so much a narrative of the eruption, as a record of his uncle's singular death, yet it is of great interest as yielding the impressions of an observer. The translation which follows is adopted from the very free version of Melmoth, except in one or two places, where it differs much from the ordinary text. The letters are given entire, though some parts are rather specimens of style than good examples of description.

"Your request that I should send an account of my uncle's death, in order to transmit a more exact relation of it to posterity, deserves my acknowledgments; for if this accident shall be celebrated by your pen, the glory of it, I am assured, will be rendered forever illustrious. And, notwithstanding he perished by a misfortune which, as it involved at the same time a most beautiful country in ruins, and destroyed so many populous cities, seems to promise

MOUNT VESUVIUS BEFORE ERUPTION OF A. D. 79.

him an everlasting remembrance; notwithstanding he has himself composed many and lasting works; yet I am persuaded the mention of him in your immortal works will greatly contribute to eternize his name. Happy I esteem those to be, whom Providence has distinguished with the abilities either of doing such actions as are worthy of being related, or of relating them in a manner worthy of being read; but doubly happy are they who are blessed with

both these talents; in the number of which my uncle, as his own writings and your history will prove, may justly be ranked. It is with extreme willingness, therefore, that I execute your commands; and should, indeed, have claimed the task if you had not enjoined it.

"He was at that time with the fleet under his command at Misenum. On the 24th of August, about one in the afternoon, my mother desired him to observe a cloud which appeared of a very unusual size and shape. He had just returned from taking the benefit of the sun, and, after bathing himself in cold water, and taking a slight repast, had retired to his study. He immediately arose, and went out upon an eminence, from whence he might more distinctly view this very uncommon appearance. It was not at that distance discernible from what mountain the cloud issued, but it was found afterward to ascend from Mount Vesuvius. I cannot give a more exact description of its figure than by comparing it to that of a pine tree, for it shot up to a great height in the form of a trunk, which extended itself at the top into a sort of branches; occasioned, I imagine, either by a sudden gust of air that impelled it, the force of which decreased as it advanced upwards, or the cloud itself being pressed back again by its own weight, and expanding in this manner: it appeared sometimes bright, and sometimes dark and spotted, as it was more or less impregnated with earth and cinders.

"This extraordinary phenomenon excited my uncle's philosophical curiosity to take a nearer view of it. He ordered a light vessel to be got ready, and gave me the liberty, if I thought proper, to attend him. I rather chose to continue my studies, for, as it happened, he had given me an employment of that kind. As he was passing out of the house he received dispatches: the marines at Retina, terrified at the imminent peril (for the place lay beneath the mountain, and there was no retreat but by ships), entreated his

aid in this extremity. He accordingly changed his first design, and what he began with a philosophical he pursued with an heroical turn of mind.

THE VOYAGE TO STABIÆ

"He ordered the galleys to put to sea, and went himself on board with an intention of assisting not only Retina but many other places, for the population is thick on that beautiful coast. When hastening to the place from whence others fled with the utmost terror, he steered a direct course to the point of danger, and with so much calmness and presence of mind, as to be able to make and dictate his observations upon the motion and figure of that dreadful scene. He was now so nigh the mountain that the cinders, which grew thicker and hotter the nearer he approached, fell into the ships, together with pumice-stones, and black pieces of burning rock; they were in danger of not only being left aground by the sudden retreat of the sea, but also from the vast fragments which rolled down from the mountain, and obstructed all the shore.

"Here he stopped to consider whether he should return back again; to which the pilot advised him. 'Fortune,' said he, 'favors the brave; carry me to Pomponianus.' Pomponianus was then at Stabiæ, separated by a gulf, which the sea, after several insensible windings, forms upon the shore. He (Pomponianus) had already sent his baggage on board; for though he was not at that time in actual danger, yet being within view of it, and indeed extremely near, if it should in the least increase, he was determined to put to sea as soon as the wind should change. It was favorable, however, for carrying my uncle to Pomponianus, whom he found in the greatest consternation. He embraced him with tenderness, encouraging and exhorting him to keep up his spirits; and the more to dissipate his fears he ordered, with an air of unconcern, the

baths to be got ready; when, after having bathed, he sat down to supper with great cheerfulness, or at least (what is equally heroic) with all the appearance of it.

"In the meantime, the eruption from Mount Vesuvius flamed out in several places with much violence, which the darkness of the night contributed to render still more visible and dreadful. But my uncle, in order to soothe the apprehensions of his friend, assured him it was only the burning of the villages, which the country people had abandoned to the flames; after this he retired to rest, and it was most certain he was so little discomposed as to fall into a deep sleep; for, being pretty fat, and breathing hard, those who attended without actually heard him snore. The court which led to his apartment being now almost filled with stones and ashes, if he had continued there any longer it would have been impossible for him to have made his way out; it was thought proper, therefore, to awaken him. He got up and went to Pomponianus and the rest of his company, who were not unconcered enough to think of going to bed. They consulted together whether it would be most prudent to trust to the houses, which now shook from side to side with frequent and violent concussions; or to fly to the open fields, where the calcined stone and cinders, though light indeed, yet fell in large showers and threatened destruction. In this distress they resolved for the fields as the less dangerous situation of the two—a resolution which, while the rest of the company were hurried into it by their fears, my uncle embraced upon cool and deliberate consideration.

DEATH OF PLINY THE ELDER

"They went out, then, having pillows tied upon their heads with napkins; and this was their whole defence against the storm of stones that fell around them It was now day everywhere else,

but there a deeper darkness prevailed than in the most obscure night; which, however, was in some degree dissipated by torches and other lights of various kinds. They thought proper to go down further upon the shore, to observe if they might safely put out to sea; but they found that the waves still ran extremely high and boisterous. There my uncle, having drunk a draught or two of cold water, threw himself down upon a cloth which was spread for him, when immediately the flames, and a strong smell of sulphur which was the forerunner of them, dispersed the rest of the company, and obliged him to rise. He raised himself up with the assistance of two of his servants, and instantly fell down dead, suffocated, as I conjecture, by some gross and noxious vapor, having always had weak lungs, and being frequently subject to a difficulty of breathing.

"As soon as it was light again, which was not till the third day after this melancholy accident, his body was found entire, and without any marks of violence upon it, exactly in the same posture as that in which he fell, and looking more like a man asleep than dead. During all this time my mother and I were at Misenum. But this has no connection with your history, as your inquiry went no farther than concerning my uncle's death; with that, therefore, I will put an end to my letter. Suffer me only to add, that I have faithfully related to you what I was either an eye-witness of myself, or received immediately after the accident happened, and before there was any time to vary the truth. You will choose out of this narrative such circumstances as shall be most suitable to your purpose; for there is a great difference between what is proper for a letter and a history; between writing to a friend and writing to the public. Farewell."

In this account, which was drawn up some years after the event, from the recollections of a student eighteen years old, we recognize

the continual earthquakes; the agitated sea with its uplifted bed; the flames and vapors of an ordinary eruption, probably attended by lava as well as ashes. But it seems likely that the author's memory, or rather the information communicated to him regarding the closing scene of Pliny's life, was defective. Flames and sulphurous vapors could hardly be actually present at Stabiæ, ten miles from the centre of the eruption.

That lava flowed at all from Vesuvius on this occasion has been usually denied; chiefly because at Pompeii and Herculaneum the causes of destruction were different—ashes overwhelmed the former, mud concreted over the latter. We observe, indeed, phenomena on the shore near Torre del Greco which seem to require the belief that currents of lava had been solidified there at some period before the construction of certain walls and floors, and other works of Roman date. In the Oxford Museum, among the specimens of lava to which the dates are assigned, is one referred to A. D. 79, but there is no mode of proving it to have belonged to the eruption of that date.

PLINY'S SECOND LETTER

A second letter from Pliny to Tacitus (*Epist.* 20) was required to satisfy the curiosity of that historian; especially as regards the events which happened under the eyes of his friend. Here it is according to Melmoth:

"The letter which, in compliance with your request, I wrote to you concerning the death of my uncle, has raised, it seems, your curiosity to know what terrors and danger attended me while I continued at Misenum: for there, I think, the account in my former letter broke off.

'Though my shocked soul recoils, my tongue shall tell.'

"My uncle having left us, I pursued the studies which prevented my going with him till it was time to bathe. After which I went to supper, and from thence to bed, where my sleep was greatly broken and disturbed. There had been, for many days before, some shocks of an earthquake, which the less surprised us as they are extremely frequent in Campania; but they were so particularly violent that night, that they not only shook everything about us, but seemed, indeed, to threaten total destruction. My mother flew to my chamber, where she found me rising in order to awaken her. We went out into a small court belonging to the house, which separated the sea from the buildings. As I was at that time but eighteen years of age, I know not whether I should call my behavior, in this dangerous juncture, courage or rashness; but I took up Livy, and amused myself with turning over that author, and even making extracts from him, as if all about me had been in full security. While we were in this posture, a friend of my uncle's, who was just come from Spain to pay him a visit, joined us; and observing me sitting with my mother with a book in my hand, greatly condemned her calmness at the same time that he reproved me for my careless security. Nevertheless, I still went on with my author.

"Though it was now morning, the light was exceedingly faint and languid; the buildings all around us tottered; and, though we stood upon open ground, yet as the place was narrow and confined, there was no remaining there without certain and great danger: we therefore resolved to quit the town. The people followed us in the utmost consternation, and, as to a mind distracted with terror every suggestion seems more prudent than its own, pressed in great crowds about us in our way out.

"Being got to a convenient distance from the houses, we stood still, in the midst of a most dangerous and dreadful scene. The

chariots which we had ordered to be drawn out were so agitated backwards and forwards, though upon the most level ground, that we could not keep them steady, even by supporting them with large stones. The sea seemed to roll back upon itself, and to be driven from its banks by the convulsive motion of the earth; it is certain at least that the shore was considerably enlarged, and many sea animals were left upon it. On the other side a black and dreadful cloud, bursting with an igneous serpentine vapor, darted out a long train of fire, resembling flashes of lightning, but much larger.

FEAR VERSUS COMPOSURE

"Upon this the Spanish friend whom I have mentioned, addressed himself to my mother and me with great warmth and earnestness; 'If your brother and your uncle,' said he, 'is safe, he certainly wishes you to be so too; but if he has perished, it was his desire, no doubt, that you might both survive him: why therefore do you delay your escape a moment?' We could never think of our own safety, we said, while we were uncertain of his. Hereupon our friend left us, and withdrew with the utmost precipitation. Soon afterward, the cloud seemed to descend, and cover the whole ocean; as it certainly did the island of Capreæ, and the promontory of Misenum. My mother strongly conjured me to make my escape at any rate, which, as I was young, I might easily do; as for herself, she said, her age and corpulency rendered all attempts of that sort impossible. However, she would willingly meet death, if she could have the satisfaction of seeing that she was not the occasion of mine. But I absolutely refused to leave her, and taking her by the hand, I led her on; she complied with great reluctance, and not without many reproaches to herself for retarding my flight.

"The ashes now began to fall upon us, though in no great

quantity. I turned my head and observed behind us a thick smoke, which came rolling after us like a torrent. I proposed, while we yet had any light, to turn out of the high road lest she should be pressed to death in the dark by the crowd that followed us. We had scarce stepped out of the path when darkness overspread us, not like that of a cloudy night, or when there is no moon, but of a room when it is all shut up and all the lights are extinct. Nothing then was to be heard but the shrieks of women, the screams of children and the cries of men; some calling for their children, others for their parents, others for their husbands, and only distinguishing each other by their voices; one lamenting his own fate, another that of his family; some wishing to die from the very fear of dying; some lifting their hands to the gods; but the greater part imagining that the last and eternal night was come, which was to destroy the gods and the world together. Among them were some who augmented the real terrors by imaginary ones, and made the frighted multitude believe that Misenum was actually in flames.

"At length a glimmering light appeared, which we imagined to be rather the forerunner of an approaching burst of flames, as in truth it was, than the return of day. However, the fire fell at a distance from us; then again we were immersed in thick darkness, and a heavy shower of ashes rained upon us, which we were obliged every now and then to shake off, otherwise we should have been crushed and buried in the heap.

"I might boast that, during all this scene of horror, not a sigh or expression of fear escaped me, had not my support been founded in that miserable, though strong, consolation that all mankind were involved in the same calamity, and that I imagined I was perishing with the world itself! At last this dreadful darkness was dissipated by degrees, like a cloud of smoke; the real day returned,

and soon the sun appeared, though very faintly, and as when an eclipse is coming on. Every object that presented itself to our eyes (which were extremely weakened) seemed changed, being covered over with white ashes, as with a deep snow. We returned to Misenum, where we refreshed ourselves as well as we could, and passed an anxious night between hope and fear, for the earthquake still continued, while several greatly excited people ran up and down, heightening their own and their friends' calamities by terrible predictions. However, my mother and I, notwithstanding the danger we had passed and that which still threatened us, had no thoughts of leaving the place till we should receive some account from my uncle.

"And now you will read this narrative without any view of inserting it in your history, of which it is by no means worthy; and, indeed, you must impute it to your own request if it shall not even deserve the trouble of a letter. Farewell!"

DION CASSIUS ON THE ERUPTION

The story told by Pliny is the only one upon which we can rely. Dion Cassius, the historian, who wrote more than a century later, does not hesitate to use his imagination, telling us that Pompeii was buried under showers of ashes "while all the people were sitting in the theatre." This statement has been effectively made use of by Bulwer, in his "Last Days of Pompeii." In this he pictures for us a gladiatorial combat in the arena, with thousands of deeply interested spectators occupying the surrounding seats. The novelist works his story up to a thrilling climax in which the volcano plays a leading part.

This is all very well as a vivid piece of fiction, but it does not accord with fact, since Dion Cassius was undoubtedly incorrect in

his statement. We now know from the evidence furnished by the excavations that none of the people were destroyed in the theatres, and, indeed, that there were very few who did not escape from both cities. It is very likely that many of them returned and dug down for the most valued treasures in their buried habitations. Dion Cassius may have obtained the material for his accounts from the traditions of the descendants of survivors, and if so he shows how terrible must have been the impression made upon their minds. He assures us that during the eruption a multitude of men of superhuman nature appeared, sometimes on the mountain and sometimes in the environs, that stones and smoke were thrown out, the sun was hidden, and then the giants seemed to rise again, while the sounds of trumpets were heard.

LAKE AVERNUS

Not far from Vesuvius lay the famous Lake Avernus, whose name was long a popular synonym for the infernal regions. The lake is harmless to-day, but its reputation indicates that it was not always so. There is every reason to believe that it hides the outlet of an extinct volcano, and that long after the volcano ceased to be active it emitted gases as fatal to animal life as those suffocating vapors which annihilated all the cattle on the Island of Lancerote, in the Canaries, in the year 1730. Its name signifies "birdless," indicating that its ascending vapors were fatal to all birds that attempted to fly above its surface.

In the superstition of the Middle Ages Vesuvius assumed the character which had before been given to Avernus, and was regarded as the mouth of hell. Cardinal Damiano, in a letter to Pope Nicholas II., written about the year 1060, tells the story of how a priest, who had left his mother ill at Beneventum, went on

his homeward way to Naples past the crater of Vesuvius, and heard issuing therefrom the voice of his mother in great agony. He afterward found that her death coincided exactly with the time at which he had heard her voice.

A trip to the summit of Vesuvius is one of the principal attractions for strangers who are visiting Naples. There is a fascination about that awful slayer of cities which few can resist, and no

A LATER VIEW OF MOUNT VESUVIUS

less attractive is the city of Pompeii, now largely laid bare after being buried for eighteen centuries. We are indebted to Henry Haynie for the following interesting description: "Once seen, it will never be forgotten. It is full of suggestions. It kindles emotions that are worth the kindling, and brings on dreams that are worth the dreaming. Of the three places overwhelmed, Herculaneum, Pompeii and Stabiæ, the last scarcely repays excavation in one

sense, and the first in another; but to watch the diggers at Pompeii is fascinating, even when there is no reasonable expectation of a find. Herculaneum was buried with lava, or rather with tufa, and it is so very hard that the expense of uncovering of only a small part of that city has been very great.

HOW POMPEII IMPRESSES ITS VISITORS

"Pompeii was smothered in ashes, however, and most of it is uncovered now. But while there is much that is fascinating, and all of it is instructive, there is nothing grand or awe-inspiring in the ruins of Pompeii. No visitor stands breathless as in the great hall of Karnak or in the once dreadful Coliseum at Rome, or dreams with sensuous delight as before the Jasmine Court at Agra.

"The weirdness of the scene possesses us as a haunted chamber might. We have before us the narrow lanes, paved with tufa, in which Roman wagon wheels have worn deep ruts. We cross streets on stepping-stones which sandaled feet ages ago polished. We see the wine shops with empty jars, counters stained with liquor, stone mills where the wheat was ground, and the very ovens in which bread was baked more than eighteen centuries ago. 'Welcome' is offered us at one silent, broken doorway; at another we are warned to 'Beware of the dog!' The painted figures,—some of them so artistic and rich in colors that pictures of them are disbelieved,—the mosaic pavements, the empty fountains, the altars and household gods, the marble pillars and the small gardens are there just as the owners left them. Some of the walls are scribbled over by the small boys of Pompeii in strange characters which mock modern erudition. In places we read the advertisements of gladiatorial shows, never to come off, the names of candidates for legislative office who were never to sit. There is nothing like this elsewhere

"The value of Pompeii to those classic students who would understand, not the speech only, but the life and the every-day habits, of the ancient world, is too high for reckoning. Its inestimable evidence may be seen in the fact that any high-school boy can draw the plan of a Roman house, while ripest scholars hesitate, on the very threshhold of a Greek dwelling. This is because no Hellenic Pompeii has yet been discovered, but thanks to the silent city close to the beautiful Bay of Naples, the Latin house is known from ostium to porticus, from the front door to the back garden wall.

STREETS AND HOUSES OF POMPEII

"The streets of Pompeii must have had a charm unapproached by those of any city now in existence. The stores, indeed, were wretched little dens. Two or three of them commonly occupied the front of a house on either side of the entrance, the ostium; but when the door lay open, as was usually the case, a passerby could look into the atrium, prettily decorated and hung with rich stuffs. The sunshine entered through an aperture in the roof, and shone on the waters of the impluvium, the mosaic floor, the altar of the household gods and the flowers around the fountain.

"As the life of the Pompeiians was all outdoors, their pretty homes stood open always. There was indeed a curtain betwixt the atrium and the peristyle, but it was drawn only when the master gave a banquet. Thus a wayfarer in the street could see, beyond the hall described and its busy servants, the white columns of the peristyle, with creepers trained about them, flowers all around, and jets of water playing through pipes which are still in place. In many cases the garden itself could be observed between the pillars of the further gallery, and rich paintings on the wall beyond that.

"But how far removed those little palaces of Pompeii were from our notion of well-being is scarcely to be understood by one who has not seen them. It is a question strange in all points of view where the family slept in the houses, nearly all of which had no second story. In the most graceful villas the three to five sleeping chambers round the atrium and four round the peristyle were rather ornamental cupboards than aught else. One did not differ from another, and if these were devoted to the household the slaves, male and female, must have slept on the floor outside. The master, his family and his guest used these small, dark rooms, which were apparently without such common luxuries as we expect in the humblest home. All their furniture could hardly have been more than a bed and a footstool; but it should be remembered that the public bath was a daily amusement. The kitchen of each villa certainly was not furnished with such ingenuity, expense or thought as the stories of Roman gormandising would have led us to expect. In the house of the Ædile—so called from the fact that 'Pansam Æd.' is inscribed in red characters by the doorway—the cook seems to have been employed in frying eggs at the moment when increasing danger put him to flight. His range, four partitions of brick, was very small; a knife, a strainer, a pan lay by the fire just as they fell from the slave's hand."

VALUE OF THE DISCOVERY OF POMPEII

This description strongly presents to us the principal value of the discovery of Pompeii. Interesting as are the numerous works of art found in its habitations, and important as is their bearing upon some branches of the art of the ancient world, this cannot compare in interest with the flood of light which is here thrown on ancient life in all its details, enabling us to picture to ourselves the

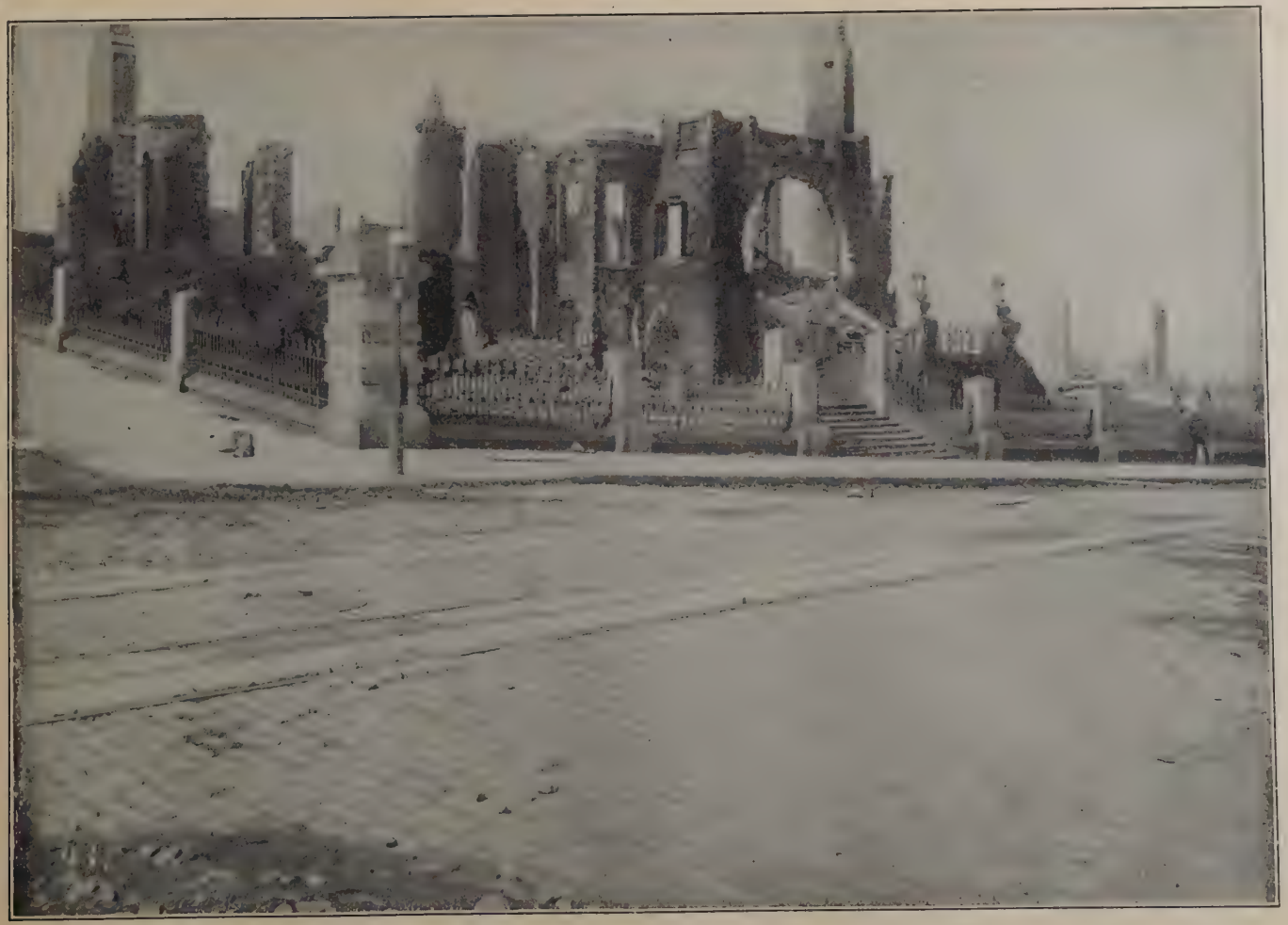
Copyright, 1906, by W. E. Scull.

REFUGEES LEAVING THE FERRY HOUSE, SAN FRANCISCO.

Twisted and toppling in the consuming heat, the tall tower of the Ferry House stood like a silhoutte against the lurid background of flame.

A STREET IN CHINATOWN.

The largest Chinese colony in America occupied the northeastern section of San Francisco. Its flimsy buildings made it an easy prey to the flames.



ONE OF THE RUINED PALACES ON NOB HILL, SAN FRANCISCO.

This photograph shows all that was left of the magnificent home of Charles Crocker, one of San Francisco's millionaires, after earthquake and fire had done their deadly work in 1906.

ON THE BEACH SOUTH OF THE CLIFF HOUSE AT SAN FRANCISCO.

Showing the hotel and the Sutro Baths. Many refugees escaped to the beach west of San Francisco and remained idly waiting for the conflagration to burn itself out. Notwith standing the calamity, they eagerly read the special bulletins issued by the newspapers during the disaster of 1906.

manners and habits of life of a cultivated and flourishing population at the beginning of the Christian era, to an extent which no amount of study of ancient history could yield.

Looking upon the work of the volcano as essentially destructive, as we naturally do, we have here a valuable example of its power as a preservative agent; and it is certainly singular that it is to a volcano we owe much of what we know concerning the cities, dwellings and domestic life of the people of the Roman Empire.

It would be very fortunate for students of antiquity if similar disasters had happened to cities in other ancient civilized lands, however unfortunate it might have been to their inhabitants. But doubtless we are better off without knowledge gained from ruins thus produced.

CHAPTER XXIII.

Eruptions of Vesuvius, Etna and Stromboli.

MOUNT VESUVIUS is of especial interest as being the only active volcano on the continent of Europe—all others of that region being on the islands of the Mediterranean—and for the famous ancient eruption described in the last chapter. Before this it had borne the reputation of being extinct, but since then it has frequently shown that its fires have not burned out, and has on several occasions given a vigorous display of its powers.

During the fifteen hundred years succeeding the destructive event described eruptions were of occasional occurrence, though of no great magnitude. But throughout the long intervals when Vesuvius was at rest it was noted that Etna and Ischia were more or less disturbed.

THE BIRTH OF MONTE NUOVO

In 1538 a startling evidence was given that there was no decline of energy in the volcanic system of Southern Italy. This was the sudden birth of the mountain still known as Monte Nuovo, or New Mountain, which was thrown up in the Campania near Avernus, on the spot formerly occupied by the Lucrine Lake.

For about two years prior to this event the district had been disturbed by earthquakes, which on September 27 and 28, 1538, became almost continuous. The low shore was slightly elevated, so that the sea retreated, leaving bare a strip about two hundred feet in width. The surface cracked, steam escaped, and at last,

early on the morning of the 29th, a greater rent was made, from which were vomited furiously "smoke, fire, stones and mud composed of ashes, making at the time of its opening a noise like the loudest thunder."

The ejected material in less than twelve hours built the hill which has lasted substantially in the same form to our day. It is a noteworthy fact that since the formation of Monte Nuovo there has been no volcanic disturbance in any part of the Neapolitan district except in Vesuvius, which for five centuries previous had remained largely at rest.

LAVA FROM VESUVIUS

The first recognised appearance of lava in the eruptions of Vesuvius was in the violent eruption of 1036. This was succeeded at intervals by five other outbreaks, none of them of great energy. After 1500 the crater became completely quiet, the whole mountain in time being grown over with luxuriant vegetation, while by the next century the interior of the crater became green with shrubbery, indicating that no injurious gases were escaping.

This was sleep, not death. In 1631 the awakening came in an eruption of terrible violence. Almost in a moment the green mantle of woodland and shrubbery was torn away and death and destruction left where peace and safety had seemed assured.

Seven streams of lava poured from the crater and swept rapidly down the mountain side, leaving ruin along their paths. Resina, Granasello and Torre del Greco, three villages that had grown up during the period of quiescence, were more or less overwhelmed by the molten lava. Great torrents of hot water also poured out, adding to the work of desolation. It was estimated that eighteen thousand of the inhabitants were killed.

What made the horror all the greater was a frightful error of judgment, similar to that of the Governor of Martinique at St. Pierre. The Governor of Torre del Greco had refused to be warned in time, and prevented the people from making their escape until it was too late. Not until the lava had actually reached the walls was the order for departure given. Before the order could be acted upon the molten streams burst through the walls into the crowded streets and overwhelmed the vast majority of the inhabitants.

In this violent paroxysm the whole top of the mountain is said to have been swept away, the new crater which took the place of the old one being greatly lowered. From that date Vesuvius has never been at rest for any long interval, and eruptions of some degree of violence have been rarely more than a few years apart. Of its various later manifestations of energy we select for description that of 1767, of which an interesting account by a careful observer is extant.

GREAT ERUPTION OF 1767

From the 10th of December, 1766, to March, 1767, Vesuvius was quiet; then it began to throw up stones from time to time. In April the throws were more frequent, and at night the red glare grew stronger on the cloudy columns which hung over the crater. These repeated throws of cinders, ashes and pumice-stones so much increased the small cone of eruption which had been left in the centre of the flat crateral space that its top became visible at a distance.

On the 7th of August there issued a small stream of lava from a breach in the side of a small cone; the lava gradually filled the space between the cone and the crateral edge; on the 12th of September it overflowed the crater, and ran down the mountain

Stones were ejected which took ten seconds in their fall, from which it may be computed that the height which the stones reached was 1 600 feet. Padre Torre, a great observer of Vesuvius, says they went up above a thousand feet. The lava ceased on the 18th of October, but at 8 A. M. on the 19th it rushed out at a different place, after volleys of stones had been thrown to an immense height, and the huge traditional pine-tree of smoke reappeared. On this occasion that vast phantom extended its menacing shadow over Capri, at a distance of twenty-eight miles from Vesuvius.

The lava at first came out of a mouth about one hundred yards below the crater, on the side toward Monte Somma. While occupied in viewing this current, the observer heard a violent noise within the mountain; saw it split open at the distance of a quarter of a mile, and saw from the new mouth a mountain of liquid fire shoot up many feet, and then, like a torrent, roll on toward him. The earth shook; stones fell thick around him; dense clouds of ashes darkened the air; loud thunders came from the mountain top, and he took to precipitate flight. The Padre's account is too lively and instructive for his own words to be omitted.

PADRE TORRE'S NARRATIVE

"I was making my observations upon the lava, which had already, from the spot where it first broke out, reached the valley, when, on a sudden, about noon, I heard a violent noise within the mountain, and at a spot about a quarter of a mile off the place where I stood the mountain split; and with much noise, from this new mouth, a fountain of liquid fire shot up many feet high, and then like a torrent rolled on directly towards us. The earth shook at the same time that a volley of stones fell thick upon us; in an instant clouds of black smoke and ashes caused almost a total

darkness; the explosions from the top of the mountain were much louder than any thunder I ever heard, and the smell of the sulphur was very offensive. My guide, alarmed, took to his heels; and I must confess that I was not at my ease. I followed close, and we ran near three miles without stopping; as the earth continued to shake under our feet, I was apprehensive of the opening of a fresh mouth which might have cut off our retreat.

"I also feared that the violent explosions would detach some of the rocks off the mountain of Somma, under which we were obliged to pass; besides, the pumice-stones, falling upon us like hail, were of such a size as to cause a disagreeable sensation in the part upon which they fell. After having taken breath, as the earth trembled greatly I thought it most prudent to leave the mountain and return to my villa, where I found my family in great alarm at the continual and violent explosions of the volcano, which shook our house to its very foundation, the doors and windows swinging upon their hinges.

"About two of the clock in the afternoon (19th) another lava stream forced its way out of the same place from whence came the lava of last year, so that the conflagration was soon as great on this side of the mountain as on the other which I had just left. I observed on my way to Naples, which was in less than two hours after I had left the mountain, that the lava had actually covered three miles of the very road through which we had retreated. This river of lava in the Atrio del Cavallo was sixty or seventy feet deep, and in some places nearly two miles broad. Besides the explosions, which were frequent, there was a continued subterranean and violent rumbling noise, which lasted five hours in the night,—supposed to arise from contact of the lava with rain-water lodged in cavities within. The whole neighborhood was shaken

violently; Portici and Naples were in the extremity of alarm; the churches were filled; the streets were thronged with processions of saints, and various ceremonies were performed to quell the fury of the mountain.

"In the night of the 20th, the occasion being critical, the prisoners in the public jail attempted to escape, and the mob set fire to the gates of the residence of the Cardinal Archbishop because he refused to bring out the relics of St. Januarius. The 21st was a quieter day, but the whole violence of the eruption returned on the 22d, at 10 A. M., with the same thundering noise, but more violent and alarming. Ashes fell in abundance in the streets of Naples, covering the housetops and balconies an inch deep. Ships at sea, twenty leagues from Naples, were covered with them.

"In the midst of these horrors, the mob, growing tumultuous and impatient, obliged the Cardinal to bring out the head of St. Januarius, at the extremity of Naples, toward Vesuvius; and it is well attested here that the eruption ceased the moment the saint came in sight of the mountain. It is true the noise ceased about that time after having lasted five hours, as it had done the preceding days.

"On the 23d the lava still ran, but on the 24th it ceased; but smoke continued. On the 25th there rose a vast column of black smoke, giving out much forked lightning with thunder, in a sky quite clear except for the smoke of the volcano. On the 26th smoke continued, but on the 27th the eruption came to an end."

This eruption was also described by Sir William Hamilton, who continued to keep a close watch on the movements of the volcano for many years. The next outbreak of especial violence took place in 1779, when what seemed to the eye a column of fire ascended two miles high, while cinder fragments fell far and wide,

destroying the hopes of harvest throughout a wide district. They fell in abundance thirty miles distant, and the dust of the explosion was carried a hundred miles away.

In 1793 the crater became active again, and in 1794, after a period of short tranquillity or comparative inaction, the mountain again became agitated, and one of the most formidable eruptions known in the history of Vesuvius began. It was in some respects unlike many others, being somewhat peculiar as to the place of its outburst, the temperature of the lava, and the course of the current. Breislak, an Italian geologist, observed the characteristic phenomena with the eye of science, and his account supplies many interesting facts.

BREISLAK ON THE ERUPTION OF 1794

Breislak remarked certain changes in the character of the earth-motions during this six hours' eruption, which led him to some particular conjecture of the cause. At the beginning the trembling was continual, and accompanied by a hollow noise, similar to that occasioned by a river falling into a subterranean cavern. The lava, at the time of its being disgorged, from the impetuous and uninterrupted manner in which it was ejected, causing it to strike violently against the walls of the vent, occasioned a continual oscillation of the mountain. Toward the middle of the night this vibratory motion ceased, and was succeeded by distant shocks. The fluid mass, diminished in quantity, now pressed less violently against the walls of the aperture, and no longer issued in a continual and gushing stream, but only at intervals when the interior fermentation elevated the boiling matter above the mouth. About 4 A. M. the shocks began to be less numerous, and the intervals between them rendered their force and duration more perceptible.

During this tremendous eruption at the base of the Vesuvian cone, and the fearful earthquakes which accompanied it, the summit was tranquil. The sky was serene, the stars were brilliant, and only over Vesuvius hung a thick, dark smoke-cloud, lighted up into an auroral arch by the glare of a stream of fire more than two miles long, and more than a quarter of a mile broad. The sea was calm, and reflected the red glare; while from the source of the lava came continual jets of uprushing incandescent stones. Nearer to view, Torre del Greco in flames, and clouds of black smoke, with falling houses, presented a dark and tragical foreground, heightened by the subterranean thunder of the mountain, and the groans and lamentations of fifteen thousand ruined men, women and children.

The heavy clouds of ashes which were thrown out on this occasion gathered in the early morning into a mighty shadow over Naples and the neighborhood; the sun rose pale and obscure, and a long, dim twilight reigned afterward.

Such were the phenomena on the western side of Vesuvius. They were matched by others on the eastern aspect, not visible at Naples, except by reflection of their light in the atmosphere. The lava on this side flowed eastward, along a route often traversed by lava, by the broken crest of the Cognolo and the valley of Sorienta. The extreme length to which this current reached was not less than an Italian mile. The cubic content was estimated to be half that already assigned to the western currents. Taken together they amounted to 20,744,445 cubic metres, or 2,804,440 cubic fathoms; the constitution of the lava being the same in each, both springing from one deep-seated reservoir of fluid rock.

The eruption of lava ceased on the 16th, and then followed heavy discharges of ashes, violent shocks of earthquakes, thunder and lightning in the columns of vapors and ashes, and finally heavy

rains, lasting till the 3d of July. The barometer during all the eruption was steady.

Breislak made an approximate calculation of the quantity of ashes which fell on Vesuvius during this great eruption, and states the result as equal to what would cover a circular area 6 kilometres (about 3½ English miles) in radius, and 39 centimetres (about 15 inches) in depth.

STRANGE EFFECTS

Among the notable things which attended this eruption, it is recorded that in Torre del Greco metallic and other substances exposed to the current were variously affected. Silver was melted, glass became porcelain, iron swelled to four times its volume and lost its texture. Brass was decomposed, and its constituent copper crystallized in cubic and octahedral forms aggregated in beautiful branches. Zinc was sometimes turned to blende. During the eruption, the lip of the crater toward Bosco Tre Case on the south-east, fell in, or was thrown off, and the height of that part was reduced 426 feet.

On the 17th, the sea was found in a boiling state 100 yards off the new promontory made by the lava of Torre del Greco, and no boat could remain near it on account of the melting of the pitch in her bottom. For nearly a month after the eruption vast quantities of fine white ashes, mixed with volumes of steam, were thrown out from the crater; the clouds thus generated were condensed into heavy rain, and large tracts of the Vesuvian slopes were deluged with volcanic mud. It filled ravines, such as Fosso Grande, and concreted and hardened there into pumiceous tufa—a very instructive phenomenon.

Immense injury was done to the rich territory of Somma, Ottajano and Bosco by heavy rains, which swept along cinders, broke

up the road and bridges, and overturned trees and houses for the space of fifteen days.

There were few years during the nineteenth century in which Vesuvius did not show symptoms of its internal fires, and at intervals it manifested much activity, though not equaling the terrible eruptions of its past history. The severest eruptions in that century were those of 1871 and 1876. In the first a sudden emission of lava killed twenty spectators at the mouth of the crater, and only spent its fury after San Sebastian and Massa had been well nigh annihilated. Fragments of rock were thrown up to the height of 4,000 feet, and the explosions were so violent that the whole countryside fled panic stricken to Naples. The activity of the volcano, accompanied by distinct shocks of earthquake, lasted for a week.

In 1876, for three weeks together, lava streamed down the side of Vesuvius, sweeping away the village of Cercolo and running nearly to the sea at Ponte Maddaloni. There were then formed ten small craters within the greater one. But these were united by a later eruption in 1888, and pressure from beneath formed a vast cone where they had been.

HARDIHOOD OF THE PEOPLE

It may seem strange that so dangerous a neighborhood should be inhabited. But so it is. Though Pompeii, Herculaneum and Stabiæ lie buried beneath the mud and ashes belched out of the mouth of Vesuvius, the villages of Portici and Revina, Torre del Greco and Torre del Annunziata have taken their place, and a large population, cheerful and prosperous, flourishes around the disturbed mountain and over the district of which it is the somewhat untrustworthy safety-valve.

It is thus that man, in his eagerness to cultivate all available parts of the earth, dares the most frightful perils and ventures into the most threatening situations, seeking to snatch the means of life from the very jaws of death. The danger is soon forgotten, the need of cultivation of the ground is ever pressing, and no threats of peril seem capable of restraining the activity of man for many years. Though the proposition of abandoning the Island of Martinique has been seriously considered, the chances are that, before many years have passed, a cheerful and busy population will be at work again on the flanks of Mont Pelee.

MOUNT ETNA

On the eastern coast of the Island of Sicily, and not far from the sea, rises in solitary grandeur Mount Etna, the largest and highest of European volcanoes. Its height above the level of the sea is a little over 10,870 feet, considerably above the limit of perpetual snow. It accordingly presents the striking phenomenon of volcanic vapors ascending from a snow-clad summit. The base of the mountain is eighty-seven miles in circumference, and nearly circular; but there is a wide additional extent all around overspread by its lava. The lower portions of the mountain are exceedingly fertile, and richly adorned with corn-fields, vineyards, olive-groves and orchards. Above this region are extensive forests, chiefly of oak, chesnut, and pine, with here and there clumps of cork-trees and beech. In this forest region are grassy glades, which afford rich pasture to numerous flocks. Above the forest lies a volcanic desert, covered with black lava and slag. Out of this region, which is comparatively flat, rises the principal cone, about 1,100 feet in height, having on its summit the crater, whence sulphurous vapors are continually evolved.

The great height of Etna has exerted a remarkable influence on its general conformation: for the volcanic forces have rarely been of sufficient energy to throw the lava quite up to the crater at the summit. The consequence has been, that numerous subsidiary craters and cones have been formed all around the flanks of the mountain, so that it has become rather a cluster of volcanoes than a single volcanic cone.

The eruptions of this mountain have been numerous, records of them extending back to several centuries before the Christian era, while unrecorded ones doubtless took place much further back. After the beginning of the Christian era, and more especially after the breaking forth of Vesuvius in 79 A. D., Etna enjoyed longer intervals of repose. Its eruptions since that time have nevertheless been numerous—more especially during the intervals when Vesuvius was inactive—there being a sort of alternation between the periods of great activity of the two mountains; although there are not a few instances of their having been both in action at the same time.

SIMILARITY IN ETNA'S ERUPTIONS

There is a great similarity in the character of the eruptions of Etna. Earthquakes presage the outburst, loud explosions follow, rifts and *bocche del fuoco* open in the sides of the mountain; smoke, sand, ashes and scoriæ are discharged, the action localizes itself in one or more craters, cinders are thrown up and accumulate around the crater and cone, ultimately lava rises and frequently breaks down one side of the cone where the resistance is least; then the eruption is at an end.

Smyth says: "The symptoms which precede an eruption are generally irregular clouds of smoke, *ferilli* or volcanic lightnings,

hollow intonations and local earthquakes that often alarm the surrounding country as far as Messina, and have given the whole province the name of Val Demone, as being the abode of infernal spirits. These agitations increase until the vast cauldron becomes surcharged with the fused minerals, when, if the convulsion is not sufficiently powerful to force them from the great crater (which, from its great altitude and the weight of the candent matter,

MOUNT ETNA

requires an uncommon effort), they explode through that part of the side which offers the least resistance with a grand and terrific effect, throwing red-hot stones and flakes of fire to an incredible height, and spreading ignited cinders and ashes in every direction."

After the eruption of ashes, lava frequently follows, sometimes rising to the top of the cone of cinders, at others disrupting it on the least resisting side. When the lava has reached the base of

the cone it begins to flow down the mountain, and, being then in a very fluid state, it moves with great velocity. As it cools, the sides and surface begin to harden, its velocity decreases, and after several days it moves only a few yards an hour. The internal portions, however, part slowly with their heat, and months after the eruption clouds of steam arise from the black and externally cold lava-beds after rain ; which, having penetrated through the cracks, has found its way to the heated mass within.

THE ERUPTION OF 1669

The most memorable of the eruptions of Etna was that which elevated the double cone of Monte Rossi and destroyed a large part of the city of Catania. It happened in the year 1669, and was preceded by an earthquake, which overthrew the town of Nicolosi, situated ten miles inland from Catania, and about twenty miles from the top of Etna. The eruption began with the sudden opening of an enormous fissure, extending from a little way above Nicolosi to within about a mile of the top of the principal cone, its length being twelve miles, its average breadth six feet, its depth unknown.

We have a more detailed account of this eruption than of any preceding one, as it was observed by men of science from various countries. The account from which we select is that of Alfonso Borelli, Professor of Mathematics in Catania.

From the fissure above mentioned, he says, there came a bright light. Six mouths opened in a line with it and emitted vast columns of smoke, accompanied by loud bellowings which could be heard forty miles off. Towards the close of the day a crater opened about a mile below the others, which ejected red-hot stones to a considerable distance, and afterward sand and ashes which

covered the country for a distance of sixty miles. The new crater soon vomited forth a torrent of lava which presented a front of two miles; it encircled Monpilieri, and afterward flowed towards Belpasso, a town of 8,000 inhabitants, which was speedily destroyed. Seven mouths of fire opened around the new crater, and in three days united with it, forming one large crater 800 feet in diameter. All this time the torrent of lava continued to descend, it destroying the town of Mascalucia on the 23d of March. On the same day the crater cast up great quantities of sand, ashes and scoriæ, and formed above itself the great double-coned hill now called Monté Rossi, from the red color of the ashes of which it is mainly composed.

VILLAGES AND CITIES BURIED

On the 25th very violent earthquakes occurred, and the cone above the great central crater was shaken down into the crater for the fifth time since the first century A. D. The original current of lava divided into three streams, one of which destroyed San Pietro, the second Camporotondo, and the third the lands about Mascalucia and afterward the village of Misterbianco. Fourteen villages were altogether destroyed, and the lava flowed toward Catania. At Albanelli, two miles from the city, it undermined a hill covered with cornfields and carried it forward a considerable distance. A vineyard was also seen to be floating on its fiery surface. When the lava reached the walls of Catania, it accumulated without progression until it rose to the top of the wall, 60 feet in height, and it then fell over in a fiery cascade and overwhelmed a part of the city. Another portion of the same stream threw down 120 feet of the wall and flowed into the city.

On the 23d of April the lava reached the sea, which it entered as a stream 600 yards broad and 40 feet deep. The stream had

Copyright, 1906, by W. E. Scull.

MILLIONAIRES ESCAPING IN AUTOMOBILES FROM SAN FRANCISCO.

EXCAVATED RUINS OF POMPEII.
Vesuvius in the background.

A STREET IN POMPEII.
Showing walls and pavement in the streets as found after excavations were made.

A BODY TURNED TO STONE.
Dug from the ruins of Pompeii.

FLEEING FROM THE DESTRUCTION OF POMPEII.
A realistic group of statuary.

INTERIOR OF A STEAMSHIP AT ST. PIERRE, AFTER THE WHIRLWIND OF FIRE.

This remarkable photograph shows the scathing power of volcanic fire when belched forth on the works of man.

moved at the rate of thirteen miles in twenty days, but as it cooled it moved less quickly, and during the last twenty-three days of its course, it advanced only two miles. On reaching the sea the water, of course, began to boil violently, and clouds of steam arose, carrying with them particles of scoriæ. Towards the end of April the stream on the west side of Catania, which had appeared to be consolidated, again burst forth, and flowed into the garden of the Benedictine Monastery of San Niccola, and then branched off into the city. Attempts were made to build walls to arrest its progress.

An attempt of another kind was made by a gentleman of Catania, named Pappalardo, who took fifty men with him, having previously provided them with skins for protection from the intense heat and with crowbars to effect an opening in the lava. They pierced the solid outer crust of solidified lava, and a rivulet of the molten interior immediately gushed out and flowed in the direction of Paterno, whereupon 500 men of that town, alarmed for its safety, took up arms and caused Pappalardo and his men to desist. The lava did not altogether stop for four months, and two years after it had ceased to flow it was found to be red hot beneath the surface. Even eight years after the eruption quantities of steam escaped from the lava after a shower of rain.

THE STONES EJECTED

The stones which were ejected from the crater during this eruption were often of considerable magnitude, and Borelli calculated that the diameter of one which he saw was 50 feet ; it was thrown to a distance of a mile, and as it fell it penetrated the earth to a depth of 23 feet. The volume of lava emitted during the eruption amounted to many millions of cubic feet. Ferara considers that the length of the stream was at least fifteen miles,

while its average width was between two and three miles, so that it covered at least forty square miles of surface.

Among the towns overflowed by this great eruption was Mompilieri. Thirty-five years afterward, in 1704, an excavation was made on the site of the principal church of this place, and at the depth of thirty-five feet the workmen came upon the gate, which was adorned with three statues. From under an arch which had been formed by the lava, one of these statues, with a bell and some coins, were extracted in good preservation. This fact is remarkable; for in a subsequent eruption, which happened in 1766, a hill about fifty feet in height, being surrounded on either side by two streams of lava, was in a quarter of an hour swept along by the current. The latter event may be explained by supposing that the hill in question was cavernous in its structure, and that the lava, penetrating into the cavities, forced asunder their walls, and so detached the superincumbent mass from its supports.

It is not by its streams of fire alone that Etna ravages the valleys and plains at its base. It sometimes also deluges them with great floods of water. On the 2d of March, 1755, two streams of lava, issuing from the highest crater, were at once precipitated on an enormous mass of very deep snow, which then clothed the summit. These fiery currents ran through the snow to a distance of three miles, melting it as they flowed. The consequence was, that a tremendous torrent of water rushed down the sides of the mountain, carrying with it vast quantities of sand, volcanic cinders and blocks of lava, with which it overspread the flanks of the mountain and the plains beneath, which it devastated in its course.

The volume of water was estimated at 16,000,000 cubic feet, it forming a channel two miles broad and in some places thirty-four feet deep, and flowing at the rate of two-thirds of a mile in a minute.

All the winter's snow on the mountain could not have yielded such a flood, and Lyell considered that it melted older layers of ice which had been preserved under a covering of volcanic dust.

ETNA IN 1819

Another great eruption took place in 1819, which presented some peculiarities. Near the point whence the highest stream of lava issued in 1811, there were opened three large mouths, which, with loud explosions, threw up hot cinders and sand, illuminated by a strong glare from beneath. Shortly afterwards there was opened, a little lower down, another mouth, from which a similar eruption took place; and still farther down there soon appeared a fifth, whence there flowed a torrent of lava which rapidly spread itself over the Val del Bove. During the first forty-eight hours it flowed nearly four miles, when it received a great accession. The three original mouths became united into one large crater, from which, as well as from the other two mouths below, there poured forth a vastly augmented torrent of lava, which rushed with great impetuosity down the same valley.

During its progress over this gentle slope, it acquired the usual crust of hardened slag. It directed its course towards that point at which Val del Bove opens into the narrow ravine beneath it—there being between the two a deep and almost perpendicular precipice. Arrived at this point, the lava-torrent leaped over the precipice in a vast cascade, and with a thundering noise, arising chiefly from the crashing and breaking up of the solid crust, which was in a great measure pounded to atoms by the fall; it throwing up such vast clouds of dust as to awaken an alarm that a fresh eruption had begun at this place, which is within the wooded region.

A very violent eruption, which lasted more than nine months, commenced on the 21st of August, 1852. It was first witnessed by a party of English tourists, who were ascending the mountain from Nicolosi in order to see the sunrise from the summit. As they approached the Casa Inglesi the crater commenced to give forth ashes and flames of fire. In a narrow defile they were met by a violent hurricane, which overthrew both the mules and their riders, and urged them toward the precipices of the Val del Bove. They sheltered themselves beneath some masses of lava, when suddenly an earthquake shook the mountain, and their mules in terror fled away. As day approached they returned on foot to Nicolosi, fortunately without having sustained injury. In the course of the night many *bocche del fuoco* (small lava vents) opened in that part of the Val del Bove called the Bazo di Trifoglietto, a great fissure opened at the base of the Giannicola Grande, and a crater was thrown up from which for seventeen days showers of sand and scoriæ were ejected.

EFFECT OF THE ERUPTION

During the next day a quantity of lava flowed down the Val del Bove, branching off so that one stream advanced to the foot of Monte Finocchio, and the other to Monte Calanna. Afterwards it flowed towards Zaffarana, and devastated a large tract of wooded region. Four days later a second crater was formed near the first, from which lava was emitted, together with sand and scoriæ, which caused cones to arise around the craters. The lava moved but slowly, and towards the end of August it came to a stand, only a quarter of a mile from Zaffarana.

On the second of September, Gemellaro ascended Monte Finocchio in the Val del Bove in order to witness the outburst. He states that the hill was violently agitated, like a ship at sea.

The surface of the Val del Bove appeared like a molten lake; scoriæ were thrown up from the craters to a great height, and loud explosions were heard at frequent intervals. The eruption continued to increase in violence. On October 6 two new mouths opened in the Val del Bove, emitting lava which flowed towards the valley of Calanna, and fell over the Salto della Giumenta, a precipice nearly 200 feet deep. The noise which it produced was like that of a clash of metallic masses. The eruption continued with abated violence during the early months of 1853, and it did not finally cease till May 27. The entire mass of lava ejected is estimated to have been equal to an area six miles long by two miles broad, with an average depth of about twelve feet.

This eruption was one of the grandest of all the known eruptions of Etna. During its outflow more than 2,000,000,000 cubic feet of molten lava was spread out over a space of three square miles. There have been several eruptions since its date, but none of marked prominence, though the mountain is rarely quiescent for any lengthened period.

THE LIPARI VOLCANOES

South-eastward of Ischia, between Calabria and Sicily, the Lipari Islands arrest attention for the volcanic phenomena they present. On one of these is Mount Vulcano, or Volcano, from which all this class of mountains is named. At present the best known of the Lipari volcanoes is Stromboli, which consists of a single mountain, having a very obtuse conical form. It has on one side of it several small craters, of which only one is at present in a state of activity.

The total height of the mountain is about 2000 feet, and the principal crater is situated at about two-thirds of the height. Stromboli is one of the most active volcanoes in the world. It is

mentioned as being in a state of activity by several writers before the Christian era, and the commencement of its operations extends into the past beyond the limits of tradition. Since history began its action has never wholly ceased, although it may have varied in intensity from time to time.

It has been observed that the violence of its eruptive force has a certain dependence on the weather—being always most intense when the barometer is lowest. From the position of the crater, it is possible to ascend the mountain and look down upon it from above. Even when viewed in this manner, it presents a very striking appearance. While there is an uninterrupted continuance of small explosions, there is a frequent succession of more violent eruptions, at intervals varying in length from seven to fifteen minutes.

HOFFMAN AT STROMBOLI

Several eminent observers have approached quite close to the crater, and examined it narrowly. One of these was M. Hoffman, who visited it in 1828.

This eminent geologist, while having his legs held by his companions, stretched his head over the precipice, and, looking right down into the mouth of one of the vents of the crater immediately under him, watched the play of liquid lava within it. Its surface resembled molten silver, and was constantly rising and falling at regular intervals. A bubble of white vapor rose and escaped, with a decrepitating noise, at each ascent of the lava—tossing up red-hot fragments of scoria, which continued dancing up and down with a sort of rhythmic play upon the surface. At intervals of fifteen minutes or so, there was a pause in these movements. Then followed a loud report, while the ground trembled, and there rose to the surface of the lava an immense bubble of vapor. This

bursting with a crackling noise, threw out to the height of about 1200 feet large quantities of red-hot stones and scoriæ, which, describing parabolic curves, fell in a fiery shower all around. After another brief repose, the more moderate action was resumed as before.

Lipari, a neighboring volcano, was formerly more active than Stromboli, though for centuries past it has been in a state of complete quiescence. The Island of Volcano lies south of Lipari. Its crater was active before the Christian era, and still emits sulphurous and other vapors. At present its main office is to serve as a sulphur mine. Thus the peak which gives title to all fire-breathing mountains has become a servant to man. So are the mighty fallen

CHAPTER XXIV.

Vesuvius Devastates the Region of Naples.

WE have in other chapters described the terrible work of Mount Vesuvius in the past, from the far-off era of the destruction of Pompeii down to the end of the last century. There comes before us now another frightful eruption, one of the greatest in its history, that of 1906. For thirty years before this outbreak the mighty volcano had been comparatively quiet, rarely ceasing, indeed, to smoke and fume, but giving little indication of the vast forces buried in its heart. It showed some sympathy with Mont Pelee in 1902, and continued restless after that time, but it was not until about the middle of February, 1906, that it became threatening, lava beginning to overflow from the crater and make its lurid way down the mountain's side.

It was in the middle of the first week of April that these indications rose to the danger point, the flow of lava suddenly swelling from a rivulet to a river, pouring in a gleaming flood over the crater's rim, and meeting the other streams that came streaming down the volcano's rugged flank. While this went on the mountain remained comparatively quiet, there being no explosions, though a huge cloud of volcanic ash and cinders rose high in the air until it hung over the crater in the shape of an enormous pine tree, while from it a shower of dust and sand, soon to become terrible, began to descend upon the surrounding fields and towns.

Dangerous as is Vesuvius at any time, the people of the vicinity dare its perils for the allurement of its fertile soil. A ring of populous villages encircles it, flourishing vineyards and olive groves extend on all sides, and the hand of industry does not hesitate to attack its threatening flanks. The intervals between its death-dealing throes are so long that the peasants are always ready to dare destruction for the hope of winning the means of life from its soil.

THE RIVERS OF LAVA.

All this locality was now a field of terror and death. Down on the vineyards and villages poured the smothering ashes in an ever increasing rain; toward them slowly and threateningly crawled the fiery serpents of the lava streams; and from their homes fled thousands of the terror-stricken people, frantic with horror and dismay. A number of populous villages were threatened by the lurid lava streams, the most endangered being Bosco Trecase, with its 10,000 inhabitants. Toward this devoted town poured steadily the irresistible flood of molten rock. The soldiers who had been hurried to the front sought to divert its flow by digging a wide ditch across its course and throwing up a high bank of earth, but they worked in vain. The demon of destruction was not to be robbed of its prey. The liquid stream advanced like a colossal serpent of fire, turning its head like a crawling snake to the right and left, but keeping steadily on toward the fated town. The ditch was filled; the bank gave way; the first house was reached and burst into flames; the creeping stream of fire pushed on to the next houses in its way; only then did the despairing

people desert their homes and flee for their lives, carrying with them the little they could snatch of their treasured possessions.

F. Marion Crawford, the novelist, who was present at this scene, thus describes the flight of the terrified people:

"I saw men, women and children and infants, whose mothers carried them at the breast or in their aprons, fleeing in an endless procession. Dogs, too, and cats were on the carts, and sometimes even chickens, tied together by the legs, and piles of mattresses and pillows and shapeless bundles of clothes. All were white with dust. Under the lurid glare I saw one old woman lying on her back across a cart, ghastly white and, if not dead already of fear and heat and suffocation, certainly almost gone. We ourselves could hardly breathe."

It was on Saturday, the 7th, that Bosco Trecase became the prey of the river of molten rock. During that night and the following day the crisis of the eruption came. The observatory on the mountain side was occupied by Professor Matteucci, his assistant, Professor Perret, of New York, and two domestics, all others having been sent away. Their description of the scene in which they found themselves is vividly picturesque. At midnight the situation in the observatory was terrible. The forces of the earthquake were let loose and the ground rocked so that it was almost impossible to stand. The roaring of the main crater was deafening, while the volcano poured forth its contents like a fountain, and the electric display was terrifying, constant claps of thunder following the lurid flashes of lightning, which gave the sky a blood-red hue.

Shortly after three o'clock in the morning the explosive energy of the mighty mass culminated. The whole cone burst open with

a tremendous earthquake shock, from the heart of the recently silent mountain came a deafening roar, and red-hot rocks, like the balls from nature's mighty artillery, were hurled a half mile into the air, while a dense mass of ashes and sand was flung to three or four times this height. All the next day the terrible detonation kept up, and a hail of bullet-like stones poured downward from the skies. Rarely has a more terrible Sunday been seen. It was as if the demons of earth and air were let loose and were seeking to destroy man and his puny works.

THE CRISIS OF THE ERUPTION.

This frightful explosion of the 8th of April was the worst of the dreadful display of volcanic forces, but the work kept up with diminishing intensity much of the following week. The ashes and cinders continued to pour down in suffocating showers, covering the ground to a depth of four or five feet in the vicinity of the volcano and to a considerable depth at Naples, ten miles away. The sun disappeared behind the thick cloud that filled the air, and the scene resembled that described by Pliny more than eighteen hundred years before.

Of Bosco Trecase nothing was left but the large stone church and a few houses. Another river of lava reached the outskirts of Torre del Greco, and a third stopped at the cemetery of Torre Annunziata. Those towns escaped, but thousands of acres of fertile cultivated land, with farm houses and stock, were destroyed. The peninsular railway up the mountain was ruined and the large hotel burned. One writer tells the following tale of what he saw on that fatal Saturday and Sunday:

"On the road I met hundreds of families in flight, carrying their few miserable possessions. The spectacle of collapsing carts and fainting women was frequently seen. When one reached the lava stream a stupefying spectacle presented itself. From a point on the mountain between the towns I saw four rivers of molten fire, one of which, 200 feet wide and over 40 deep, was moving slowly and majestically onward, devouring vineyards and olive groves. I witnessed the destruction of a farm house enveloped on three sides by lava. Immediately overhead the great crater was belching incandescent rock and scoria for an incredible distance. The whole scene was wreathed with flames, and a perpetual roar was heard. Ever and anon the cone of the volcano was encircled with vivid electric phenomena, amid which a downpour of liquid fire on all sides of the crater was revealed in magnificent awfulness. In the evening there was a frightful shock of earthquake, which was repeated at two o'clock on Sunday morning. Simultaneously the lava streams redoubled their onrush, and men, women and children fled precipitately toward the sea. The lava had invaded the road behind them."

A REIGN OF TERROR.

The great loss of life was due to the vast fall of ashes, which crushed in hundreds of roofs and buried the occupants within the ruins of their homes. In all the neighboring towns buildings were destroyed in great numbers, an early estimate being that fully 5,000 houses had been partly crushed or utterly destroyed. On the Ottajano side of the mountain, where the ashes fell in greatest pro-

fusion, all the houses of the villages were damaged, and Ottajano itself was left a wreck, several hundred dead bodies being taken from its ruins. In Naples the ash fall was so incessant that those who could afford it wore automobile coats, caps and goggles, while the people generally sought to save their eyes and faces by the aid of paper masks and umbrellas. The drivers of trolley cars were obliged to wear masks of some transparent material under the vizors of their caps.

DISASTERS AT SAN GIUSEPPE AND NAPLES.

There were two special disasters attended by serious loss of life. On the 9th, while a congregation of two hundred or more were attending mass in the church at San Giuseppe, the roof crushed in from the weight of ashes upon it and fell upon the worshippers below, few or none of whom escaped unhurt. Fifty-four dead bodies were taken from the ruins and a large number were severely injured. The Mayor of the town was dismissed from his office for leaving his post of duty in the face of danger.

The second disaster, one of the same character, took place at Naples. This was on Tuesday, April 10th. Just previous to it the people had been marching in religious processions through the streets, to render thanks for the apparent cessation of the activity of Vesuvius. Motley but picturesque processions were these, headed by boys carrying candles, which burned simply in the full sunshine and bearing aloft images of the Madonna or saints, clad in gorgeous robes of cheap blue or yellow satin. Their joy was suddenly changed to grief by tidings of a frightful disaster. The roof of the Monte

Oliveto market, fronting on the Toledo, the main thoroughfare, had suddenly crushed in, burying more than 200 people beneath its heavy fall.

The market had been crowded with buyers and their children, and it was the busiest hours of the day in the great roofed court-yard, covering a space 600 feet square, when, with scarcely a tremor of warning, there came a frightful crash and a dense cloud of dust covered the scene, from out of which came heartrending screams of agony. The volcanic ash which, unnoticed, had gathered thickly on the roof, had broken it in by its weight.

The news set the people frantic with grief and indignation. They insisted that the authorities knew that the roof was unsafe and had neglected their duty. Cursing and screaming in their intense excitement, they surrounded the market, endeavoring with frantic haste to remove the heavy beams from beneath which came the appealing calls for help, many of the rescuers sobbing aloud as they worked. It required a large force of police and soldiers to keep them back and permit the firemen and other trained workers to carry on more systematically the work of relief. Twelve persons proved to have been killed, two fatally injured, twenty-four seriously hurt and over a hundred badly bruised and cut. Among these were many children, whose parents had sent them to do the marketing without a dream of danger, and the grief of the parents was intense. The Duke of Aosta, Prefect of Naples, directed the work of rescue, while his wife assisted in the care of the injured. As the Duchess bent in the hospital to give a cooling drink to a badly bruised little girl she felt a kiss upon her hand. Looking down, she saw a woman

kneeling at her feet, who gratefully said: "Your Excellency, she is all I have. I am a widow. May God reward you."

While this scene of horror was taking place in Naples the fate of the town and villages grouped around the foot of the volcano seemed as hopeless as ever. Early on the 10th the showers of ashes and streams of lava diminished and almost ceased, but later the same day they began again, and the terrified inhabitants feared that a catastrophe like that which buried Pompeii and Herculaneum was about to visit them. The lava which reached the cemetery of Torre Annunziata turned in the direction of Pompeii as if to freshly entomb that exhumed city of the past. A violent storm of sulphurous rain fell at San Giuseppe, Vesuviana and Sariano, and on all sides the fall of sand and ashes came on again in full strength. Even with the sun shining high in the heavens the light was a dim yellow, in the midst of which the few persons who still haunted the stricken towns moved about in the awful stillness of desolation like gray ghosts, their clothing, hair and beards covered with ashes.

THE ERUPTION RESUMED.

A typical case was that of Torre del Greco. Though for thirty hours the place had been deserted, a few ghostly figures could be seen at intervals when the vivid flashes of lightning illuminated the gloom-covered scene, wandering desolutely about, hungry and thirsty, their throats parched by smoke and dust, yet unable to tear themselves away from the ruins of their late comfortable homes.

So deep was the ash fall that railway or tramway travel to the inner circle of towns was impossible, and the great depth of

fallen dust choked the roads so as to render travel by carriage or on foot very difficult. A party of officials made a tour of inspection by automobile, visiting a number of the town, but were prevented by the state of the roads from reaching others. Ottajano was thus cut off from travel, and a heavy fall of ashes followed the officials in their retreat. At Bosco Trecase the lava had gathered into a lake, already growing solid on top, but a mass of liquid rock beneath.

The lava carried vast masses of burnt stone and sulphur on its surface, like dross on melted lead, and nothing was visible toward Bosco Trecase but endless acres of dark scoriae, broken here and there by the greenish, curling smoke of sulphur. At one point a great cone pine tree, torn up by its roots and turned to black charcoal, stuck out of the mass at a sharp angle. The air was almost unbearable, the heat intense, and few could long bear the dangers and discomfort of the situation.

SCENES OF HORROR.

The greatest depth of ashes encountered was in the vicinity of Ottajano. Here large areas were buried to a depth of several feet. Soldiers had been sent there with military carts, carrying provisions and surgical appliances, with orders to lend their aid in the work of relief. They found it almost impossible to make their way through the deep fine dust, and the tales of horror and heroism they had to tell resembled those that must of old have been borne to Rome by the fleeing inhabitants of Pompeii.

Efforts were made to remove the children and old persons in the carts, but when these had gone a few hundred feet it was found that, although there were four horses harnessed to each vehicle.

they could not pull their loads through the ashes. This caused a panic among the children, who expected to be buried in the incessant fall from the volcano, and they fled in all directions in the darkness and blinding rain. Searching parties went after them, but in spite of continuous shouting and calling no trace was found of the little ones, and numbers of the children were undoubtedly smothered by the ashes and sand.

Many of the inhabitants had been buried in the ruins of their houses, and the scenes when the victims were unearthed were often piteous and terrible. The positions of the bodies showed that the victims had died while in a state of great terror, the faces being convulsed with fear. Three bodies were found in a confessional of one of the fallen churches. One body was that of an old woman who was sitting with her right arm raised as though to ward off the advancing danger. The second was that of a child about eight years old. It was found dead in a position which would indicate that the child had fallen with a little dog close to it and had died with one arm raised across its face, to protect itself and pet from the crumbling ruins. The third body, that of a woman, was reduced to an unrecognizable mass. These three victims were reverently laid side by side while a procession of friends and relatives offered up prayers beside them.

One soldier rode his horse through the ashes reaching up to its flanks, calling out, "Who wants help?" He was rewarded by hearing a woman's voice reply in weak tones and, springing from his horse, he floundered through the ashes to the ruined walls of a house from which the voice seemed to come. As he made his way through the soft, treacherous layer of scoriæ which surrounded the destroyed habitation, and with difficulty worked his way

toward the building the soldier shouted words of encouragement and, climbing over a heap of ruins and braving a toppling wall, entered the building. In the cellar he found the bodies of three children. Near them was a woman, barely alive, who by almost superhuman efforts for hours had succeeded in freeing herself from a mass of debris which had fallen upon her. The soldier picked the woman up in his arms and carried her to a place of safety. It was found that both legs were broken and that she had been badly crushed about the body.

Some extraordinary escapes from death took place. A man and his four children were rescued after having been lost in the ash-covered wilderness for fifty-six hours. They were terribly exhausted, and were reduced almost to skeletons.

Robert Underwood Johnson, one of the editors of the "Century Magazine, who happened to be in Rome at the time of the eruption, made one of a party who ventured as near the scene of destruction as they could safely approach. From his graphic story of his experiences we copy some of the most interesting details.

AN AMERICAN OBSERVER.

"We caught a train for Torre Annunziata, three miles this side of Pompeii and two miles from the southern end of the wedge of lava which destroyed Bosco Trecase. We had a magnificent view of the eruption, eight miles away. Rising at an angle of fifty degrees, the vast mass of tumult roundness was beautifully accentuated by the full moon, shifting momentarily into new forms and drifting south in low, black clouds of ashes and cinders reaching to Capri. At Torre del Greco we ran under this terrifying pall, apparently a hundred feet above, the solidity of which was soon

revealed in the moonlight. The torches of the railway guards added to the effect, but greatly relieved the sulphurous darkness.

"We reached Torre Annunziata at three in the morning. There was little suggestion of a disaster as we trudged through the sleeping town to the lava, two miles away. The brilliant moon gave us a superb view of the volcano, a gray-brown mass rising, expanding and curling in with a profile like a monstrous cyclopean face. But nothing in mythology gives a suggestion of the fascination of this awful force, presenting the sublime beauty above, but in its descent filled with the mysterious malignance of God's underworld.

"We reached the lava at a picturesque cypress-planted cemetery on the northern boundary of Torre Annunziata. It was as if the dead had effectually cried out to arrest the crushing river of flames which pitilessly engulfed the statue of St. Anne with which the people of Bosco Reale tried to stay it, as at Catania the veil of St. Agathe is said to have stayed a similar stream from Mount Etna.

"We climbed on the lava. It was cool above but still alive with fire below. We could see dimly the extent of the destruction beyond the barrier of brown which had enclosed the streets, torn down the houses, invaded the vineyards and broken Cook's railways. A better idea of the surroundings was obtained at dawn from the railway. We saw north what was left of Bosco Trecase—a great, square stone church and a few houses inland in a sea of dull, brown lava. North and east rose a thousand patches of blue smoke like swamp miasma. All was dull and desolate slag, with nowhere the familiar serpentine forms of the old lava streams. In terrible contrast with the volcanic evidences were strong cypresses and blooming camelias in a neighboring cemetery.

"We ate a hasty luncheon before sunrise, when the great beauty

of the scene was revealed. The column now seemed higher and more massive, rising to three times the height of Vesuvius. Each portion had a concentric motion and new aspects. The south edges floating toward the sea showed exquisite curved surfaces, due to the upper moving current. It was like the decoration of the side of a great sarcophagus. As a yellow dust hangs over Naples and hides the volcano, I count myself fortunate to have seen all day from leeward this spectacle of changing, undiminishing beauty.

"The wedge of cultivated land ruined east of the volcano extended at least ten miles, with a width of twenty or thirty miles. Fancy a rich and thickly populated country of vineyards lying under three to six inches of ashes and cinders of the color of chocolate with milk, while above, to the west, the volcano in full activity is distributing to the outer edges of the circle the same fate, and you will get an idea of the desolate impression of the scene, a tragedy colossal and heartrending. Like that of Calabria, it enlists the sympathy of the civilized world. It takes time for such a calamity to be realized.

"Two miles below San Giuseppe we struck cinders which the soldiers were shoveling, making a narrow road for the refugees. Our wagon driver begged off from completing his contract to take us to San Giuseppe. We had not the heart to insist, so the rest of the journey to the railway at Palma, eight miles, was made laboriously on foot for three hours through sliding cinders.

"In many places temporary shelters had been built by the roadside, like children's playhouses. Here women were huddled with their bedding, awaiting the coming of supplies which the army had begun to distribute. The men were largely occupied with shoveling cinders from the stronger roofs and floors into heaps

three to six feet deep along the roadside. Many two-wheeled carts loaded with salvage, drawn by donkeys or pushed by peasants, were making their way along, the women with bundles on their heads or carrying poultry.

"In the square of San Giuseppe was an encampment of soldiers, with low tents. Near a destroyed church, in coarse yellow linen shrouds, were the bodies of thirty-three of the persons who there lost their lives. The peasants were sad, but uncomplaining; in fact, for so excitable a people they were wonderfully calm. As evidence of the thrift and self-respect of these, we were not once asked for alms during the afternoon."

THE KING AT THE FRONT.

The Italian Government did all it could at the moment to alleviate the horrors of the situation, sending money to be expended in relief work and dispatching high officials of the government to give aid and encouragement by their presence. The King, Victor Emmanuel, and Queen Helene reached the scene of destruction as early as possible and lent their personal assistance to the work of rescue.

Obliged to leave his automobile, which could not move over the cinder-choked road, the King went forward with difficulty on horseback, the animal floundering through four feet of ashes, stumbling into holes, and half blinded by the fall of dust and cinders.

"How did you esape?" he asked a priest whom he met in his journey.

"I put myself in safety," was the reply.

"What do you mean?" asked the King.

"Realizing the danger, I left Nola."

"What!" cried the King, with a flush of anger. "You, a minister of God, were not here to share the danger of your people and administer the last sacraments? You did very wrong and forgot your duty."

Reaching Ottajano, the King did what he could to expedite the work of rescue at that central point of disaster, more than a hundred dead bodies being taken from the ruins in his presence. He stood with set pale face watching the removal of the victims and directing the movement of the workers. During his visit at the front he inspected the temporary camp hospitals, in which the soldiers were caring for the injured and suffering, speaking to the poor victims, giving them what comfort he could, and asking what he could do to relieve their distress. Every request or desire was received with sympathy and orders given to have it fulfilled.

A pitiful scene took place when the King bent over a poor man, whose right leg had been amputated, and asked what he could do to comfort and aid him in his affliction.

"Send me my son, who is serving as a soldier," said the maimed peasant.

The King, visibly affected, clasped the old man's hand and exclaimed:

"My poor fellow! I can do much, but to grant your request would mean breaking the laws, which I must be the first to respect. I would give anything I have were it possible by so doing to send your son to you, but I cannot do so."

While the King was thus engaged at the scenes of desolation, Queen Helene visited the charitable institutions at Naples and inspected the places where the refugees were housed, doing what she could to improve conditions and add to the comfort of the

sufferers. The Princess of Schleswig-Holstein, who was in Naples, made an automobile visit to the afflicted towns, but the motor broke down, and she was forced to return on foot, walking a distance of twelve miles through the ashes and displaying a power of endurance that surprised the natives.

THE CANOPY OF DUST.

By Friday, April 13th, the eruption was practically at an end. Vesuvius had spent itself in the enormous convulsion of the 7th and 8th and the subsequent minor explosions and had returned to its normal state, ceasing to give any signs of life, except the cloud of smoke which still rose from its crater and spread like a thick curtain over and around the mountain. Looked at from Naples, there was none of the familiar aspects of the volcano, with its output of smoke and ashes by day and fiery gleam by night. Now it lay buried in darkness and obscurity, clothed in a dense pall of smoke. At Rome there was sunshine, but twenty miles south hung a misty veil, and twenty-five miles above Naples a zone of semi-obscurity began, blotting out the sun, whose light trickled through with a sickly glare. Everything was whitened with powdery dust; pretty white villas were daubed and dripping with mud, and people were busy shoveling the ashes from their roofs.

The crowds at the stations resembled millers, their clothes flour covered; the Campania presented the appearance of a Dakota prairie after a blizzard of snow, though everything was gray instead of white. The ashes lay in drifts knee deep. As the volcano was approached semi-night replaced the day, the gloom being so deep that telegraph poles twenty feet away could not be seen. Breathing was difficult, and the smoke made the eyes water. At Naples,

however, a favorable wind had cleared the air of smoke, the sun shone brightly, and the versatile people were happy once more. The goggles and eye-screens had disappeared, but the streets were anything but comfortable, for some six thousand men were at work clearing the ashes from the roofs and main streets and piling them in the middle of the narrow streets, making the passage of vehicles very difficult and the sidewalks far from comfortable for foot passengers.

But while brightness and joy reigned at Naples, there were gruesome scenes within the volcanic zone. At Bosco Trecase soldiers carried on the work of exhumation, being able to work only an hour at a time on account of the advanced stage of decomposition of the bodies. Many of these were shapeless, unrecognizable masses of flesh and bones, while others were little disfigured. To lessen the danger of an epidemic the bodies were buried as quickly as possible in quicklime.

On Sunday, the 15th, the searchers at Ottajano were surprised at finding two aged women still alive, after six days' entombment in the ruins. They were among those who had been buried by the falling walls a week before. The rafters of the house had protected them, and a few morsels of food in their pockets aided to keep them alive. At some points there the ashes were ten feet deep. At San Giuseppe bodies of women were found in whose hands were coins and jewels, and one woman held a jewelled rosary. This recalls the results of exploration at Herculaneum and Pompeii, where were similar instances of death overtaking the victims of the volcano while fleeing with their jewels in their hands.

It is interesting to learn that two men stood heroically to their post of duty during the whole scene of the explosion, Professor

Matteucci, Director of the Royal Observatory, and his American assistant, Professor Frank A. Perret, of New York. Though the building occupied by them was exposed to the full force of the rain of stones from the burning mountain, they remained undauntedly at their post through that week of terror. On the 14th some of that venturesome fraternity, the newspaper correspondents, reached their eyrie on the highest habitable point on Vesuvius and heard the story of their experiences.

THE HEROES OF THE OBSERVATORY.

For several days Professors Matteucci and Perret and their two servants had been cut off from the outside world and bombarded by the volcano, their rations consisting of bread, cheese and dried onions, until on Friday a hardy guide was induced to push through to them with some provisions. During the eruption the Professor had kept at his instruments, taking observations day and night and making calculations in the midst of the inferno. Roughly dressed, he looked like a Western cowboy after a hard ride in a dust storm. The portico where he stood was knee deep in ashes, and from the observatory terrace narrow paths had been cut through the ashes, but as far as the eye could reach an ocean of ashes and twisted rivers were alone visible, with Vesuvius rising grimly in the midst. The great monster was enveloped in a cloak of white, as if buried under a snowstorm, its surface being here and there slit with gulches in which lava ran. At the bottom of one of those gulches lay the wrecked remnants of the peninsular railway, a portion of its twisted cable protruding through the ashes. As the correspondents ascended the mountain they were surprised by the apparition of natives, men wrinkled with age, who emerged from dug-

outs just below the observatory and offered them milk and eggs, just as if they were ordinary visitors to the volcano. As they descended they heard the sound of a mandolin from one of these dugouts. Evidently Vesuvius had no terrors for these case-hardened veterans.

We have already told the story gleaned by the correspondents from the daring scientists. Matteucci completed his record of boldness on Friday, the 13th, by climbing to a point far above the observatory, at the imminent risk of his life, to observe the conditions then existing. From what he say he believed the end of the disturbance near, though he did not venture to predict. As for the ashes, which a light wind was then blowing in a direction away from Naples, he said: "The ill wind is now blowing good to other places, for ashes are the best fertilizer it is possible to use. It is merely a question just now of having too much of a good thing."

This is a fact so far as the volcanic ash is concerned. An examination of the ashes a few days ago shows that they will prove an active and valuable fertilizer. The fertile slopes of Vesuvius have ever been an allurement to the vine-grower, four crops a year being a temptation no possible danger could drive him from, and as soon as the mountain grows surely peaceful after this eruption, we shall find its farmers risking again the chance of its uncertain temper. But this is not the case with the land covered with lava and cinders. Time for their disintegration is necessary before they can be brought under cultivation, and this is a matter of years. After the great eruption of 1871-72 the land covered with cinders did not bear crops for seven years, and there is no reason that they will do so sooner on the present occasion. So for years to come much of the volcanic soil must remain a barren and desert void.

CHAPTER XXV.

Skaptar Jökull and Hecla, the Great Icelandic Volcanoes.

THE far-northern island of Iceland, on the verge of the frozen Arctic realm, is one of the most volcanic countries in the world, whether we regard the number of volcanoes concentrated in so small a space, or the extraordinary violence of their eruptions. Of volcanic mountains there are no less than twenty which have been active during historical times. Skaptar in the north, and Hecla in the south, being much the best known. In all, twenty-three eruptions áre on record.

Iceland's volcanoes rival Mount Ætna in height and magnitude, their action has been more continuous and intense, and the range of volcanic products is far greater than in Sicily. The latter island, indeed, is not one-tenth of volcanic origin, while the whole of Iceland is due to the work of subterranean forces. It is entirely made up of volcanic rocks, and has seemingly been built up during the ages from the depths of the seas. It is reported, indeed, that a new island, the work of volcanic forces, appeared opposite Mount Hecla in 1563; but this statement is open to doubt.

VOLCANOES IN ICELAND

The eruptions of the volcanoes in Iceland have been amongst the most terrible of those carefully recorded. The cold climate of the island and the height of the mountains produce vast quantities of snow and ice, which cover the volcanoes and fill up the cracks

and valleys in their sides. When, therefore, an eruption commences, the intense heat of the boiling lava, and of the steam which rushes forth from the crater, makes the whole mountain hot, and vast masses of ice, great fields of snow, and deluges of water roll down the hill-sides into the plains. The lava pours from the top and from cracks in the side of the mountain, or is ejected hundreds of feet, to fall amongst the ice and snow; and the great masses of red-hot stone cast forth, accompanied by cinders and fine ashes, splash into the roaring torrent, which tears up rocks in its course and devastates the surrounding country for miles.

DREADFUL FLOODS

An eruption of Kotlugja, in 1860, was accompanied by dreadful floods. It began with a number of earthquakes, which shook the surrounding country. Then a dark columnar cloud of vapor was seen to rise by day from the mountain, and by night balls of fire (volcanic bombs) and red-hot cinders to the height of 24,000 feet (nearly five miles), which were seen at a distance of 180 miles. Deluges of water rushed from the heights, bearing along whole fields of ice and rocky fragments of every size, some vomited from the volcano, but in great part torn from the flanks of the mountain itself and carried to the sea, there to add considerably to the coast-line after devastating the intervening country. The fountain of volcanic bombs consisted of masses of lava, containing gases which exploded and produced a loud sound, which was said to have been heard at a distance of 100 miles. The size of the bombs, and the height to which they must have reached, were very great. But the most remarkable of the historical eruptions in Iceland were those of Skaptar Jökull in 1783, and of Hecla in 1845. Of these an extended description is worthy of being given.

Of these two memorable eruptions, that of Skaptar-Jökull began on the 11th of June, 1783. It was preceded by a long series of earthquakes, which had become exceedingly violent immediately before the eruption. On the 8th, volcanic vapors were emitted from the summit of the mountain, and on the 11th immense torrents of lava began to be poured forth from numerous mouths. These torrents united to form a large stream, which, flowing down into the river Skapta, not only dried it up, but completely filled the vast gorge through which the river had held its course. This gorge, 200 feet in breadth, and from 400 to 600 feet in depth, the lava filled so entirely as to overflow to a considerable extent the fields on either side. On issuing from this ravine, the lava flowed into a deep lake which lay in the course of the river. Here it was arrested for a while; but it ultimately filled the bed of the lake altogether—either drying up its waters, or chasing them before it into the lower part of the river's course. Still forced onward by the accumulation of molten lava from behind, the stream resumed its advance, till it reached some ancient volcanic rocks which were full of caverns. Into these it entered, and where it could not eat its way by melting the old rock, it forced a passage by shivering the solid mass and throwing its broken fragments into the air to a height of 150 feet.

A TORRENT OF LAVA

On the 18th of June there opened above the first mouth a second of large dimensions, whence poured another immense torrent of lava, which flowed with great rapidity over the solidified surface of the first stream, and ultimately combined with it to form a more formidable main current. When this fresh stream reached the fiery lake, which had filled the lower portion of the valley of the Skapta, a portion of it was forced up the channel of that river,

towards the foot of the hill whence it takes its rise. After pursuing its course for several days, the main body of this stream reached the edge of a great waterfall called Stapafoss, which plunged into a deep abyss. Displacing the water, the lava here leaped over the precipice, and formed a great cataract of fire. After this, it filled the channel of the river, though extending itself in breadth far beyond it, and followed it until it reached the sea.

ENORMOUS QUANTITY OF LAVA

The 3rd of August brought fresh accessions to the flood of lava still pouring from the mountain. There being no room in the channel, now filled by the former lurid stream, which had pursued a northwesterly course, the fresh lava was forced to take a new direction towards the southeast, where it entered the bed of another river with a barbaric name. Here it pursued a course similar to that which flowed through the channel of the Skapta, filling up the deep gorges, and then spreading itself out into great fiery lakes over the plains.

The eruptions of lava from the mountain continued, with some short intervals, for two years, and so enormous was the quantity poured forth during this period that, according to a careful estimate which has been made, the whole together would form a mass equal to that of Mont Blanc. Of the two streams, the greater was fifty, the less forty, miles in length. The Skapta branch attained on the plains a breadth varying from twelve to fifteen miles—that of the other was only about half as much. Each of the currents had an average depth of 100 feet, but in the deep gorges it was no less than 600 feet. Even as late as 1794 vapors continued to rise from these great streams, and the water contained in the numerous fissures formed in their crust was hot.

The devastation directly wrought by the lava currents themselves was not the whole of the evils they brought upon unfortunate Iceland and its inhabitants. Partly owing to the sudden melting of the snows and glaciers of the mountain, partly owing to the stoppage of the river courses, immense floods of water deluged the country in the neighborhood, destroying many villages and a large amount of agricultural and other property. Twenty villages were overwhelmed by the lava currents, while the ashes thrown out during the eruption covered the whole island and the surface of the sea for miles around its shores. On several occasions the ashes were drifted by the winds over considerable parts of the European continent, obscuring the sun and giving the sky a gray and gloomy aspect. In certain respects they reproduced the phenomena of the explosion of Mount Krakatoa, which, singularly, occurred just a century later, in 1883. The strange red sunset phenomena of the latter were reproduced by this Icelandic event of the eighteenth century.

Out of the 50,000 persons who then inhabited Iceland, 9,336 perished, together with 11,460 head of cattle, 190,480 sheep and 28,000 horses. This dreadful destruction of life was caused partly by the direct action of the lava currents, partly by the noxious vapors they emitted, partly by the floods of water, partly by the destruction of the herbage by the falling ashes, and lastly in consequence of the desertion of the coasts by the fish, which formed a large portion of the food of the people.

ERUPTION OF MOUNT HECLA

After this frightful eruption, no serious volcanic disturbance took place in Iceland untill 1845, when Mount Hecla again became disastrously active. Mount Hecla has been the most frequent in its

eruptions of any of the Icelandic volcanoes. Previous to 1845 there had been twenty-two recorded eruptions of this mountain, since the discovery of Iceland in the ninth century; while from all the other volcanoes in the island there had been only twenty during the same period. Hecla has more than once remained in activity for six years at a time—a circumstance that has rendered it the best known of the volcanoes of this region.

LATER OUTBREAKS

After enjoying a long rest of seventy-nine years, this volcano burst again into violent activity in the beginning of September, 1845. The first inkling of this eruption was conveyed to the British Islands by a fall of volcanic ashes in the Orkneys, which occurred on the night of September 2nd during a violent storm. This palpable hint was soon confirmed by direct intelligence from Copenhagen. On the 1st of September a severe earthquake, followed the same night by fearful subterranean noises, alarmed the inhabitants and gave warning of what was to come. About noon the next day, with a dreadful crash, there opened in the sides of the volcano two new mouths, whence two great streams of glowing lava poured forth. They fortunately flowed down the northern and northwestern sides of the mountain, where the low grounds are mere barren heaths, affording a scanty pasture for a few sheep. These were driven before the fiery stream, but several of them were burnt before they could escape. The whole mountain was enveloped in clouds of volcanic ashes and vapors. The rivers near the lava currents became so hot as to kill the fish, and to be impassable even on horseback.

About a fortnight later there was a fresh eruption, of greater violence, which lasted twenty-two hours, and was accompanied by

detonations so loud as to be heard over the whole island. Two new craters were formed, one on the southern, the other on the eastern slope of the cone. The lava issuing from these craters flowed to a distance of more than twenty-two miles. At about two miles from its source the fiery stream was a mile wide, and from 40 to 50 feet deep. It destroyed a large extent of fine pasture and many cattle. Nearly a month later, on the 15th of October, a fresh flood of lava burst from the southern crater, and soon heaped up a mass at the foot of the mountain from 40 to 60 feet in height, three great columns of vapor, dust and ashes rising at the same time from the three new craters of the volcano. The mountain continued in a state of greater or less activity during most of the next year; and even as late as the month of October, 1846, after a brief pause, it began again with renewed vehemence. The volumes of dust, ashes and vapor, thrown up from the craters, and brightly illuminated by the glowing lava beneath, assumed the appearance of flames, and ascended to an immense height.

ELECTRIC PHENOMENA

Among the stones tossed out of the craters was one large mass of pumice weighing nearly half a ton, which was carried to a distance of between four and five miles. The rivers were flooded by the melting of ice and snow which had accumulated on the mountain. The greatest mischief wrought by these successive eruptions was the destruction of the pasturages, which were for the most part covered with volcanic ashes. Even where left exposed, the herbage acquired a poisonous taint which proved fatal to the cattle, inducing among them a peculiar murrain. Fortunately, owing to the nature of the district through which the lava passed, there was on this occasion no loss of human life.

The Icelandic volcanoes are remarkable for the electric phenomena which they produce in the atmosphere. Violent thunder-storms, with showers of rain and hail, are frequent accompaniments of volcanic eruptions everywhere; but owing to the coldness and dryness of the air into which the vapors from the Icelandic volcanoes ascend, their condensation is so sudden and violent that great quantities of electricity are developed. Thunder-storms accompanied by the most vivid lightnings are the result. Humboldt mentions in his "Cosmos" that, during an eruption of Kotlugja, one of the southern Icelandic volcanoes, the lightning from the cloud of volcanic vapor killed eleven horses and two men (Cosmos i. 223). Great displays of the aurora borealis usually accompany the volcanic eruptions of this island—doubtless resulting from the quantity of electricity imparted to the higher atmosphere by the condensation of the ascending vapors. On the 18th of August, 1783, while the great eruption of Skaptar Jökull was in progress, an immense fire-ball passed over England and the European continent as far as Rome. This ball which was estimated to have had a diameter exceeding half a mile, is supposed to have been of electrical origin, and due to the high state of electric tension in the atmosphere over Iceland at that time.

CHAPTER XXVI.

Volcanoes of the Philippines and Other Pacific Islands.

WE cannot do better than open this chapter with an account of the work of volcanoes in the mountain-girdled East Indian island of Java. This large and fertile tropical island has a large native population, and many European settlers are employed in cultivating spices, coffee and woods. The island is rather more than 600 miles long, and it is not 150 miles broad in any part; and this narrow shape is produced by a chain of volcanoes which runs along it. There is scarcely any other region in the world where volcanoes are so numerous, even in the East, where the volcano is a very common product of nature. Some of the volcanoes of Java are constantly in eruption, while others are inactive.

One of their number, Galung Gung, was previous to 1822 covered from top to bottom with a dense forest; around it were populous villages. The mountain was high; there was a slight hollow on its top—a basin-like valley, carpeted with the softest sward; brooks rippled down the hillside through the forests, and, joining their silvery streams, flowed on through beautiful valleys into the distant sea. In the month of July, 1822, there were signs of an approaching disturbance; this tranquil peacefulness was at an end; one of the rivers became muddy, and its waters grew hot.

In October, without any warning, a most terrific eruption occurred. A loud explosion was heard the earth shook, and

immense columns of hot water, boiling mud mixed with burning brimstone, ashes and stones, were hurled upwards from the mountain top like a waterspout, and with such wonderful force that large quantities fell at a distance of forty miles. Every valley near the mountain became filled with burning torrents; the rivers, swollen with hot water and mud, overflowed their banks, and swept away the escaping villagers; and the bodies of cattle, wild beasts, and birds were carried down the flooded stream.

ERUPTION OF GALUNG GUNG

A space of twenty-four miles between the mountain and a river forty miles distant was covered to such a depth with blue mud, that people were buried in their houses, and not a trace of the numerous villages and plantations was visible. The boiling mud and cinders were cast forth with such violence from the crater, that while many distant villages were utterly destroyed and buried, others much nearer the volcano were scarcely injured; and all this was done in five short hours.

Four days afterwards a second eruption occurred more violent than the first, and hot water and mud were cast forth with masses of slag like the rock called basalt some of which fell seven miles off. A violent earthquake shook the whole district, and the top of the mountain fell in, and so did one of its sides, leaving a gaping chasm. Hills appeared where there had been level land before, and the rivers changed their courses, drowning in one night 2,000 people. At some distance from the mountain a river runs through a large town, and the first intimation the inhabitants had of all this horrible destruction was the news that the bodies of men and the carcases of stags, rhinoceroses, tigers, and other animals, were rushing along to the sea. No less than 114 villages were destroyed, and above 4,000 persons were killed by this terrible catastrophe.

Fifty years before this eruption, Mount Papandayang, one of the highest burning mountains of Java, was constantly throwing out steam and smoke, but as no harm was done, the natives continued to live on its sides. Suddenly this enormous mountain fell in, and left a gap fifteen miles long and six broad. Forty villages were destroyed, some being carried down and others overwhelmed by mud and burning lava. No less than 2,957 people perished, with vast numbers of cattle; moreover, most of the coffee plantations in the neighboring districts were destroyed.

Even more terrible was the eruption of Mount Salek, another of the volcanoes of Java. The burning of the mountain was seen 100 miles away, while the thunders of its convulsions and the tremblings of the earth reached the same distance. Seven hills, at whose base ran a river—crowded with dead buffaloes, deer, apes, tigers, and crocodiles—slipped down and became a level plain. River-courses were changed, forests were burnt up, and the whole face of the country was completely altered.

Later volcanic eruptions in Java include that of 1843, when Mount Guntur flung out sand and ashes estimated at the vast total of thirty million tons, and those of 1849 and 1872 when Mount Merapi, a very active volcano, covered a great extent of country with stones and ashes, and ruined the coffee plantations of the neighboring districts.

We have said nothing concerning the most terrible explosion of all, that of the volcanic island of Krakatoa, off the Javan coast. This event was so phenomenal as to deserve a chapter of its own, for which we reserve it.

The United States, as one result of its recent acquisition of island dominions, has added largely to its wealth in volcanic mountains. The famous Hawaiian craters, far the greatest in the world,

now belong to our national estate, and the Philippine Islands contain various others, of less importance, yet some of which have proved very destructive. A description of those of the Island of Luzon, which are the most active in the archipelago, is here subjoined:

THE LUZON VOLCANOES.

Volcanoes have played an important part in the formation of the Philippine Islands and have left traces of their former activity in all directions. Most of them, however, have long been dead and silent, only a few of the once numerous group being now active. Of these there are three of importance in the southern region of Luzon—Taal, Bulusan and Mayon or Albay.

The last named of these is the largest and most active of the existing volcanoes. In form it is of marvellous grace and beauty, forming a perfect cone, about fifty miles in circuit at base and rising to a height of 8,900 feet. It is one of the most prominent landmarks to navigators in the island. From its crater streams upward a constant smoke, accompanied at times by flame, while from its depths issue subterranean sounds, often heard at a distance of many leagues. The whole surrounding country is marked by evidences of old eruptions.

This mountain, in 1767, sent up a cone of flame of forty feet in diameter at base, for ten days, and for two months a wide stream of lava poured from its crater. A month later there gushed forth great floods of water, which filled the rivers to overflow, doing widespread damage to the neighboring plantations. But its greatest and most destructive eruption took place in 1812, the year of the great eruption of the St. Vincent volcano. On this fatal occasion several towns were destroyed and no less than 12,000 people lost their lives The debris flung forth from the crater were so abundant

that deposits deep enough to bury the tallest trees were formed near the mountain. In 1867 another disastrous explosion took place, and still another in 1888. A disaster different in kind and cause occurred in 1876, when a terrible tropical storm burst upon the mountain. The floods of rain swept from its sides the loose volcanic material, and brought destruction to the neighboring country, more than six thousand houses being ruined by the rushing flood.

BULUSAN AND TAAL

Bulusan, a volcano on the southern extremity of the island, resembles Vesuvius in shape. For many years it remained dormant, but in 1852 smoke began to issue from its crater. In some respects the most interesting of these three volcanoes is that of Taal, which lies almost due south of Manila and about forty-five miles distant, on a small island in the middle of a large lake, known as Bombom or Bongbong. A remarkable feature of this volcanic mountain is that it is probably the lowest in the world, its height being only 850 feet above sea level. There are doubtful traditions that Lake Bombom, a hundred square miles in extent, was formed by a terrible eruption in 1700, by which a lofty mountain 8000 or 9000 feet high, was destroyed. The vast deposits of porous tufa in the surrounding country are certainly evidences of former great eruptions from Mount Taal.

The crater of this volcano is an immense, cup-shaped depression, a mile or more in diameter and about 800 feet deep. When recently visited by Professor Worcester, during his travels in these islands, he found it to contain three boiling lakelets of strangely-colored water, one being of a dirty brown hue, a second intensely yellow in tint, and the third of a brilliant emerald green. The mountain still steams and fumes, as if too actively at work below

to be at rest above. In past times it has shown the forces at play in its depths by breaking at times into frightful activity. Of the various explosions on record, the three most violent were those of 1716, 1749, and 1754. In the last-named year the earth for miles round quaked with the convulsive throes of the deeply disturbed mountain, and vast quantities of volcanic dust were hurled high into the air, sufficient to make it dark at midday for many leagues around. The roofs of distant Manila were covered with volcanic dust and ashes. Molten lava also poured from the crater and flowed into the lake, which boiled with the intense heat, while great showers of stones and ashes fell into its waters.

VOLCANOES IN THE SOUTHERN ISLANDS

Extinct volcanoes are numerous in Luzon, and there are smoking cones in the north, and also in the Babuyanes Islands still farther north. Volcanoes also exist in several of the other islands. On Negros is the active peak of Malaspina, and on Camiguin, an island about ninety miles to the southeast, a new volcano broke out in 1876. The large island of Mindanao has three volcanoes, of which Cottabato was in eruption in 1856 and is still active at intervals. Apo, the largest of the three, estimated to be 10,312 feet high, has three summits, within which lies the great crater, now extinct and filled with water.

In evidence of former volcanic activity are the abundant deposits of sulphur on the island of Leyte, the hot springs in various localities, and the earthquakes which occasionally bring death and destruction. Of the many of these on record, the most destructive was in 1863, when 400 people were killed and 2,000 injured, while many buildings were wrecked. Another in 1880 wrought great destruction in Manila and elsewhere though without loss of life.

An earthquake in Mindanao in 1675 opened a passage to the sea, and a vast plain emerged. These convulsions of the earth affect the form and elevation of buildings, which are rarely more than two stories high and lightly built, while translucent sea-shells replace glass in their windows.

While Java is the most prolific in volcanoes of the islands of the Malayan Archipelago, other islands of the group possess active cones, including Sumatra, Bali, Amboyna, Banda and others. In Sanguir, an island north of Celebes, is a volcanic mountain from which there was a destructive eruption in 1856. The country was devastated with lava, stones and volcanic ashes, ruining a wide district and killing nearly 3,000 of the inhabitants. Mount Madrian, in one of the Spice Islands, was rent in twain by a fierce eruption in 1646, and since then has remained two distinct mountains. It became active again in 1862, after two centuries of repose, and caused great loss of life and property. Sorea, a small island of the same group, forming but a single volcanic mountain, had an eruption in 1693, the cone crumbling gradually till a vast crater was formed, filled with liquid lava and occupying nearly half the island. This lake of fire increased in size by the same process till in the end it took possession of the island and forced all the inhabitants to flee to more hospitable shores.

THE GREAT ERUPTION OF TOMBORO

But of the East Indian Islands, Sumbawa, lying east of Java, contains the most formidable volcano—one, indeed, scarcely without a rival in the world. This is named Tomboro. Of its various eruptions the most furious on record was that of 1815. This, as we are told by Sir Stamford Raffles, far exceeded in force and duration any of the known outbreaks of Etna or Vesuvius. The

ground trembled and the echoes of its roar were heard through an area of 1,000 miles around the volcano, and to a distance of 300 miles its effects were astounding.

In Java, 300 miles away, ashes filled the air so thickly that the solar rays could not penetrate them, and fell to the depth of several inches. The detonations were so similar to the reports of artillery as to be mistaken for them. The Rajah of Sang'ir, who was an eye-witness of the eruption, thus described it to Sir Stamford:

"About 7 P. M. on the 10th of April, three distinct columns of flame burst forth near the top of the Tomboro mountain (all of them apparently within the verge of the crater), and, after ascending separately to a very great height, their tops united in the air in a troubled, confused manner. In a short time the whole mountain next Sang'ir appeared like a body of liquid fire, extending itself in every direction. The fire and columns of flame continued to rage with unabated fury, until the darkness caused by the quantity of falling matter obscured them, at about 8 P. M. Stones at this time fell very thick at Sang'ir—some of them as large as two fists, but generally not larger than walnuts. Between 9 and 10 P. M. ashes began to fall, and soon after a violent whirlwind ensued, which blew down nearly every house in the village of Sang'ir—carrying the roofs and light parts away with it. In the port of Sang'ir, adjoining Tomboro, its effects were much more violent—tearing up by the roots the largest trees, and carrying them into the air, together with men, horses, cattle, and whatever else came within its influence. This will account for the immense number of floating trees seen at sea. The sea rose nearly twelve feet higher than it had ever been known to do before, and completely spoiled the only spots of rice-land in Sang'ir—sweeping away houses and everything within its reach. The whirlwind lasted about an hour.

No explosions were heard till the whirlwind had ceased, at about 11 P. M. From midnight till the evening of the 11th, they continued without intermission. After that time their violence moderated, and they were heard only at intervals; but the explosions did not cease entirely until the 15th of July. Of all the villages of Tomboro, Tempo, containing about forty inhabitants, is the only one remaining. In Pekate no vestige of a house is left; twenty-six of the people, who were at Sumbawa at the time, are the whole of the population who have escaped. From the most particular inquiries I have been able to make, there were certainly no fewer than 12,000 individuals in Tomboro and Pekate at the time of the eruption, of whom only five or six survive. The trees and herbage of every description, along the whole of the north and west sides of the peninsula, have been completely destroyed, with the exception of those on a high point of land, near the spot where the village of Tomboro stood."

Tomboro village was not only invaded by the sea on this occasion, but its site permanently subsided; so that there is now eighteen feet of water where there was formerly dry land.

THE VOLCANOES OF JAPAN

The Japanese archipelago, as stated in an earlier chapter, is abundantly supplied with volcanoes, a number of them being active. Of these the best known to travelers is Asamayama, a mountain 8,500 feet high, of which there are several recorded eruptions. The first of these was in 1650; after which the volcano remained feebly active till 1783, when it broke out in a very severe eruption. In 1870 there was another of some severity, accompanied by violent shocks of earthquake felt at Yokohama. The crater is very deep, with irregular rocky walls of a sulphurous character.

Far the most famous of all the Japanese mountains, however, is that named Fuji-san, but commonly termed in English Fujiyama or Fusiyama. It is in the vicinity of the capital, and is the most prominent object in the landscape for many miles around. The apex is shaped somewhat like an eight-petaled lotus flower, and offers to view from different directions from three to five peaks.

Though now apparently extinct, it was formerly an active volcano, and is credited in history with several very disastrous eruptions. The last of these was in 1707, at which time the whole summit burst into flames. Rocks were split and shattered by the heat, and stones fell to the depth of several inches in Yeddo (now Tokyo), sixty miles away. At present there are in its crater, which has a depth of 700 or 800 feet, neither sulphurous exhalations nor steam. According to Japanese tradition this great peak was upheaved in a single night from the bottom of the sea, more than twenty-one hundred years ago.

Nothing can be more majestic than this volcano, extinct though it be, rising in an immense cone from the plain to the height of over twelve thousand feet, truncated at the top, and with its peak almost always snow-covered. Its ascent is not difficult to an expert climber, and has frequently been made. From its summit is unfolded a panorama beyond the power of words to describe, and probably the most remarkable on the globe. Mountains, valleys, lakes, forests and the villages of thirteen counties may be seen. As we gaze upon its beautifully shaped and lofty mass, visible even from Yokohama and a hundred miles at sea, one does not wonder that it should be regarded as a holy mountain, and that it should form a conspicuous object in every Japanese work of art. It is to the natives of Japan as Mont Blanc is to Europeans, the "monarch of mountains."

In summer pilgrimages are made around the base of the summit elevation, and there are on the upward path a number of Buddhist temples and shrines, made of blocks of stone, for devotion, shelter and the storage of food for pilgrims. Hakone Lake is three thousand feet above the sea, and probably lies in the crater of an extinct volcano. Its waters are very deep; it is several miles long and wide, and is surrounded by high hills which abound in fine scenery, solfataras and mineral springs.

HOT SPRINGS NEAR HAKONE LAKE

At this place the mountain seems to be smouldering, as sulphur fumes and steam issue at many points, and the ground is covered with a friable white alkaline substance. In many a hollow the water bubbles with clouds of vapor and sulphuretted hydrogen; here the soil is hot and evidently underlaid by active fires. It is not safe to go very near, as the crust is thin and crumbling. The water running down the hills has a refreshing sound and a tempting clearness, but the thirsty tongue at once detects it to be a very strong solution of alum. The whole aspect of the place is infernal, and naturally suggests the name given its principal geyser, O-gigoko (Big Hell).

Fujiyama is almost a perfect cone, with, as above said, a truncated top, in which is the crater. It is, however, less steep than Mayon. Its upper part is comparatively steep, even to thirty-five degrees, but below this portion the inclination gradually lessens, till its elegant outlines are lost in the plain from which it rises. The curves of the sides depend partly on the nature, size and shape of the ejected material, the fine uniform pieces remaining on comparatively steep slopes, while the larger and rounder ones roll farther down, resting on the inclination that afterward becomes curved from the subsidence of the central mass.

The most recent and one of the most destructive of volcanic eruptions recorded in Japan was that of Bandaisan or Baldaisan. For ages this mountain had been peaceful, and there was scarcely an indication of its volcanic character or of the terrific forces which lay dormant deep within its heart. On its flanks lay some small deposits of scoriæ, indications of far-past eruptions, and there were some hot springs at its base, while steam arose from a fissure. Yet there was nothing to warn the people of the vicinity that deadly peril lay under their feet.

BANDAISAN'S WORK OF TERROR

This sense of security was fatally dissipated on a day in July, 1888, when the mountain suddenly broke into eruption and flung 1,600 million cubic yards of its summit material so high into the air that many of the falling fragments, in their fall, struck the ground with such velocity as to be buried far out of sight. The steam and dust were driven to a height of 13,000 feet, where they spread into a canopy of much greater elevation, causing pitchy darkness beneath. There were from fifteen to twenty violent explosions, and a great landslide devastated about thirty square miles and buried many villages in the Nagase Valley.

Mr. Norman, a traveler who visited the spot shortly afterward, thus describes the scene of ruin. After a journey through the forests which clothed the slopes of the volcanic mountain and prevented any distant view, the travelers at last found themselves "standing upon the ragged edge of what was left of the mountain of Bandaisan, after two-thirds of it, including, of course, the summit, had been literally blown away and spread over the face of the country.

"The original cone of the mountain," he continues, "had been truncated at an acute angle to its axis. From our very feet a precipitous mud slope falls away for half a mile or more till it reaches the level. At our right, still below us, rises a mud wall a mile long, also sloping down to the level, and behind it is evidently the crater, but before us, for five miles in a straight line, and on each side, nearly as far, is a sea of congealed mud, broken up into ripples and waves and great billows, and bearing upon its bosom a thousand huge boulders, weighing hundreds of tons apiece."

On reaching the crater he found it to resemble a gigantic cauldron, fully a mile in width, and enclosed with precipitous walls of indurated mud. From several orifices volumes of steam rose into the air, and when the vapor cleared away for a moment glimpses of a mass of boiling mud were obtained. Before the eruption the mountain top had terminated in three peaks. Of these the highest had an elevation of about 5,800 feet. The peak destroyed was the middle one, which was rather smaller than the other two.

"The explosion was caused by steam; there was neither fire nor lava of any kind. It was, in fact, nothing more nor less than a gigantic boiler explosion. The whole top and one side of Sho-Bandai-san had been blown into the air in a lateral direction, and the earth of the mountain was converted by the escaping steam, at the moment of the explosion, into boiling mud, part of which was projected into the air to fall at a long distance, and then take the form of an overflowing river, which rushed with vast rapidity and covered the country to a depth of from 20 to 150 feet. Thirty square miles of country were thus devastated."

In the devastated lowlands and buried villages below and on the slopes of the mountain many lives were lost. From the survivors Mr. Norman gathered some information, enabling him

to describe the main features of the catastrophe. We append a brief outline of his narrative:

MR. NORMAN'S NARRATIVE

"At a few minutes past 8 o'clock in the morning a frightful noise was heard by the inhabitants of a village ten miles distant from the crater. Some of them instinctively took to flight, but before they could run much more than a hundred yards the light of day was suddenly changed into a darkness more intense than that of midnight; a shower of blinding hot ashes and sand poured down upon them; the ground was shaken with earthquakes, and explosion followed explosion, the last being the most violent of all. Many fugitives, as well as people in the houses, were overwhelmed by the deluge of mud, none of the fugitives, when overtaken by death, being more than two hundred yards from the village. From the statements made by those fortunate enough to escape with their lives, and from a personal examination of the ground, Mr. Norman inferred that the mud must have been flung fully six miles through the air and then have poured in a torrent along the ground for four miles further. All this was done in less than five minutes, so that "millions of tons of boiling mud were hurled over the country at the rate of two miles a minute."

The velocity of the mud torrent may perhaps be overestimated, but in its awful suddenness this catastrophe was evidently one with few equals. The cone destroyed may have been largely composed of rather fine ashes and scoriæ, which was almost instantaneously converted into mud by the condensing steam and the boiling water ejected. The quantity of water thus discharged must have been enormous.

Copyright by W. E. Scull.

TIDAL WAVE AT REGGIO.

Without warning great vessels lying in the harbor were struck by the devouring wall of

Copyright by W. E. Scull.

PALL OF DEATH OVER THE DOOMED CITY OF MESSINA.

Rescue parties, from Naples and Rome, quickly came to succor the survivors. From across

VAST CHASMS OPENED BY THE EARTHQUAKE.
The station master at Reggio saw an enormous vent yawn in the ground as the earthquake rocked the earth to its depths.

REGGIO, ONE OF THE STRICKEN CITIES.
Reggio di Calabria, across the strait from Messina, was a flourishing town of 60,000 inhabitants before the fatal earthquake and tidal wave obliterated it. It was estimated that 50,000 persons lost their lives in this city.

Of the remaining volcanic regions of the Pacific, the New Zealand islands present some of the most striking examples of activity. All the central parts, indeed, of the northern island of the group are of a highly volcanic character. There is here a mountain named Tongariro, on whose snow-clad summit is a deep crater, from which volcanic vapors are seen to issue, and which exhibits other indications of having been in a state of greater activity at a not very remote period of time. There is also, at no great distance from this mountain, a region containing numerous funnel-shaped chasms, emitting hot water, or steam, or sulphurous vapors, or boiling mud. The earthquakes in New Zealand had probably their origin in this volcanic focus.

THE NEW ZEALAND VOLCANOES

Tongariro has a height of about 6,500 feet, while Egmont, 8,270 feet in height, is a perfect cone with a perpetual cap of snow. There are many other volcanic mountains, and also great numbers of mud volcanoes, hot springs and geysers. It is for the latter that the island is best known to geologists. Their waters are at or near the boiling point and contain silica in abundance.

At a place called Rotomahana, in the vicinity of Mount Tarawera, there was formerly a lake of about one hundred and twenty acres in area, which was in its way one of the most remarkable bodies of water upon the earth. Formerly, we say, for this lake no longer exists, it having been destroyed by the very forces to which it owed its fame. Its waters were maintained nearly at the boiling point by the continual accession of boiling water from numerous springs. The most abundant of those sources was situated at the height of about 100 feet above the level of the lake. It kept continually filled an oval basin about 250 feet in circumference—the margins of

which were fringed all round with beautiful pure white stalactites, formed by deposits of silica, with which the hot water was strongly impregnated. At various stages below the principal spring were several others, that contributed to feed the lake at the bottom, in the centre of which was a small island. Minute bubbles continually escaped from the surface of the water with a hissing sound, and the sand all round the lake was at a high temperature. If a stick was thrust into it, very hot vapors would ascend from the hole. Not far from this lake were several small basins filled with tepid water, which was very clear, and of a blue color.

The conditions here were of a kind with those to which are due the great geysers of Iceland and the Yellowstone Park, but different in the fact that instead of being intermittent and throwing up jets at intervals, the springs allowed the water to flow from them in a continuous stream.

THE PINK AND WHITE TERRACES

The silicious incrustations left by the overflow from the large pool had made a series of terraces, two to six feet high, with the appearance of being hewn from white or pink marble; each of the basins containing a similar azure water. These terraces covered an area of about three acres, and looked like a series of cataracts changed into stone, each edge being fringed with a festoon of delicate stalactites. The water contained about eighty-five per cent. of silica, with one or two per cent. of iron alumina, and a little alkali.

There were no more beautiful products of nature upon the earth than those "pink and white terraces," as they were called. The hot springs of the Yellowstone have produced formations resembling them, but not their equal in fairy-like charm. One

series of these terraced pools and cascades was of the purest white tint, the other of the most delicate pink, the waters topping over the edge of each pool and falling in a miniature cascade to the one next below, thus keeping the edges built up by a continual renewal of the silicious incrustation. But all their beauty could not save them from utter and irremediable destruction by the forces below the earth's surface.

On June 9, 1886, a great volcanic disturbance began in the

PINK AND WHITE TERRACES OF LAKE ROTO MAHANA, NEW ZEALAND.

Auckland Lake region with a tremendous earthquake, followed during the night by many others. At seven the next morning a lead-covered cloud of pumice sand, advancing from the south, burst and discharged showers of fine dust. The range of Mount Tarawera seemed to be in full volcanic activity, including some craters supposed to be extinct, and embracing an area of one hundred and twenty miles by twenty.

The showers of dust were so thick as to turn day into night for nearly two days. Some lives were lost, and several villages were destroyed, these being covered ten feet deep with ashes, dust and clayey mud. The volcanic phenomena were of the most violent character, and the whole island appears to have been more or less convulsed. Mount Tarawera is said to be five hundred feet higher than before the eruption; glowing masses were thrown up into the air, and tongues of fiery hue, gases or illuminated vapors, five hundred feet wide, towered up one thousand feet high. The mountain was 2,700 feet in height.

TARAWERA IN ERUPTION

This eruption presented a spectacle of rarely-equalled grandeur. To travelers and strangers the greatest resultant loss will be the destruction of those world-famous curiosities, the white and pink terraces, in the vicinity of Lake Rotomahana and the region of the famous geysers. The natives have a superstition that the eruption of the extinct Tarawera was caused by the profanation of foreign footsteps. It was to them a sacred place, and its crater a repository for their dead. The first earthquake occurred in this region. One side of the mountain fell in, and then the eruption began. The basin of the lake was broken up and disappeared, but again reappeared as a boiling mud cauldron; craters burst out in various places, and the beautiful terraces were no more. After the first day the violence gradually diminished, and in a week had ceased. Very possibly another lake will be formed, and in time other terraces; but it is hardly within the range of probability that the beauty of the lost terraces will ever be paralleled.

In this eruption, as usual, we find the earthquake preceding the volcanic outburst. New Zealand, like the Philippines, Java and

the Japanese Islands, is situated over a great earth-fissure or line of weakness. Subsidence or dislocation from tensile strain of the crust took place, and the influx of water to new regions of heated strata may have developed the explosive force. The earthquake and the volcano worked together here, as they frequently do, unfortunately in this case destroying one of the most beautiful scenes on the surface of the globe.

THE ANTARCTIC VOLCANOES

Much further south, on the frozen shore of Victoria Land in the Antarctic regions, Sir James Ross, in 1841, sailing in his discovery ships the *Erebus* and *Terror*, discovered two great volcanic mountains, which he named after those two vessels. Mount Erebus is continually covered, from top to bottom, with snow and glaciers. The mountain is about 12,000 feet high, and although the snow reaches to the very edge of the crater, there rise continually from the summit immense volumes of volcanic fumes, illuminated by the glare of glowing lava beneath them. The vapors ascend to an estimated height of 2,200 feet above the top of the mountain.

CHAPTER XXVII.

The Wonderful Hawaiian Craters and Kilauea's Lake of Fire.

IN the central region of the North Pacific Ocean lies the archipelago formerly known as the Sandwich Islands, now collectively designated as Hawaii. The people of the United States should be specially interested in this island group, for it has become one of our possessions, an outlying Territory of our growing Republic, and in making it part of our national domain we have not alone extended our dominion far over the seas, but have added to the many marvels of nature within our land one of the chief wonders of the world, the stupendous Hawaiian volcanoes, before whose grandeur many of more ancient fame sink into insignificance.

THE ISLAND OF HAWAII

The Island of Hawaii, the principal island of the group, we may safely say contains the most enormous volcano of the earth. Indeed, the whole island, which is 4000 square miles in extent, may be regarded as of volcanic origin. It contains four volcanic mountains—Kohola, Hualalia, Mauna Kea and Mauna Loa. The two last named are the chief, the former being 13,800 feet, the latter 13,600 feet, above the sea-level. Although their height is so vast, the ascent to their summits is so gradual that their circumference at the base is enormous. The bulk of each of them is reckoned to be equal to two and a half times that of Etna. Some of the streams

of lava which have emanated from them are twenty-six miles in length by two miles in breadth.

On the adjoining island of Maui is a still larger volcano, the mighty Haleakala, long since extinct, but memorable as possessing the most stupendous crater on the face of the earth. The mountain itself is over 10,000 feet high, and forms a great dome-like mass of 90 miles circumference at base. The crater on its summit has a length of 7½ and a width of 2¼ miles, with a total area of about sixteen square miles. The only approach in dimensions to this enormous opening exists in the still living crater of Kilauea, on the flank of Mauna Loa.

A VOLCANIC ISLAND GROUP

The peaks named are the most apparent remnants of a world-rending volcanic activity in the remote past, by whose force this whole Hawaiian island group was lifted up from the depths of the ocean, here descending some three and a half miles below the surface level. The coral reefs which abound around the islands are of comparatively recent formation, and rest upon a substratum of lava probably ages older, which forms the base of the archipelago. The islands are volcanic peaks and ridges that have been pushed up above the surrounding seas by the profound action of the interior forces of the earth.

It must not be supposed that this action was a violent perpendicular thrust upward over a very limited locality, for the mountains continue to slope at about the same angle under the sea and for great distances on every side, so that the islands are really the crests of an extensive elevation, estimated to cover an area of about 2000 miles in one direction by 150 or 200 miles in the other. The process was probably a gradual one of up-building, by means of

which the sea receded as the land steadily rose. Some idea of the mighty forces that have been at work beneath the sea and above it can be gained by considering the enormous mass of material now above the sea-level. Thus, the bulk of the island of Hawaii, the largest of the group, has been estimated by the Hawaiian Surveyor General as containing 3,600 cubic miles of lava rock above sea-level. Taking the area of England at 50,000 square miles, this mass of volcanic matter would cover that entire country to a depth of 274 feet. We must remember, however, that what is above sea-level is only a small fraction of the total amount, since it sweeps down below the waves hundreds of miles on every side.

CRATER OF HALEAKALA

Of the lava openings on these islands, the extinct one of Haleakala, as stated, with its twenty-seven miles circumference, is far the most stupendous. It is easy of access, the mountain sides leading to it presenting a gentle slope; while the walls of the crater, in places perpendicular, in others are so sloping that man and horse can descend them. The pit varies from 1500 to 2000 feet in depth, its bottom being very irregular from the old lava flows and the many cinder cones, these still looking as fresh as though their fires had just gone out. Some of these cones are over 500 feet high. There is a tradition among the natives that the vast lava streams which in the past flowed from the crater to the sea continued to do so in the period of their remote ancestors. They still, indeed, appear as if recent, though there are to-day no signs of volcanic activity anywhere on this island.

In fact, the only volcano now active in the Hawaiian Islands is Mauna Loa, in the southern section of the Island of Hawaii. A striking feature of this is that it has two distinct and widely discon-

nected craters, one on its summit, the other on its flank, at a much lower level. The latter is the vast crater of Kilauea, the largest active crater known on the face of the globe.

MISS BIRD IN THE CRATER OF KILAUEA

We cannot offer a better description of the aspect of this lava abyss than to give Miss Bird's eloquent description of her adventurous descent into it:

"The abyss, which really is at a height of four thousand feet on the flank of Mauna Loa, has the appearance of a pit on a rolling plain. But such a pit! It is quite nine miles in circumference, and at its lowest area—which not long ago fell about three hundred feet, just as the ice on a pond falls when the water below is withdrawn—covers six square miles. The depth of the crater varies from eight hundred to one thousand feet, according as the molten sea below is at flood or ebb. Signs of volcanic activity are present more or less throughout its whole depth and for some distance along its margin, in the form of steam-cracks, jets of sulphurous vapor, blowing cones, accumulating deposits of acicular crystals of sulphur, etc., and the pit itself is constantly rent and shaken by earthquakes. Great eruptions occur with circumstances of indescribable terror and dignity; but Kilauea does not limit its activity to these outbursts, but has exhibited its marvellous phenomena through all known time in a lake or lakes on the southern part of the crater three miles from this side.

"This lake—the *Hale-mau-mau*, or "House of Everlasting Fire", of the Hawaiian mythology, the abode of the dreaded goddess Pele—is approachable with safety, except during an eruption. The spectacle, however, varies almost daily; and at times the level of the lava in the pit within a pit is so low, and the suffocating

gases are evolved in such enormous quantities, that travellers are unable to see anything.

"At the time of our visit there had been no news from it for a week; and as nothing was to be seen but a very faint bluish vapor hanging round its margin, the prospect was not encouraging. After more than an hour of very difficult climbing, we reached the lowest level of the crater, pretty nearly a mile across, presenting from above the appearance of a sea at rest; but on crossing it, we found it to be an expanse of waves and convolutions of ashy-colored lava, with huge cracks filled up with black iridescent rolls of lava only a few weeks old. Parts of it are very rough and ridgy, jammed together like field-ice, or compacted by rolls of lava, which may have swelled up from beneath; but the largest part of the area presents the appearance of huge coiled hawsers, the ropy formation of the lava rendering the illusion almost perfect. These are riven by deep cracks, which emit hot sulphurous vapors.

"As we ascended, the flow became hotter under our feet, as well as more porous and glistening. It was so hot that a shower of rain hissed as it fell upon it. The crust became increasingly insecure, and necessitated our walking in single file with the guide in front, to test the security of the footing. I fell through several times, and always into holes full of sulphurous steam so malignantly acid that my strong dogskin gloves were burned through as I raised myself on my hands.

"We had followed the lava-flow for thirty miles up to the crater's brink, and now we had toiled over recent lava for three hours, and, by all calculations, were close to the pit; yet there was no smoke or sign of fire, and I felt sure that the volcano had died out for once for my special disappointment.

"Suddenly, just above and in front of us, gory drops were tossed in the air, and springing forwards, we stood on the brink of Hale-mau-mau, which was about thirty-five feet below us. I think we all screamed. I know we all wept; but we were speechless, for a new glory and terror had been added to the earth. It is the most unutterable of wonderful things. The words of common speech are quite useless. It is unimaginable, indescribable; a sight to

CRATER OF KILAUEA, HAWAII
Fiery Lake of Molten Lava

remember forever; a sight which at once took possession of every faculty of sense and soul, removing one altogether out of the range of ordinary life. Here was the real 'bottomless pit', 'the fire which is not quenched', 'the place of Hell', 'the lake which burneth with fire and brimstone', 'the everlasting burnings', 'the fiery sea whose waves are never weary'. Perhaps those Scripture phrases were suggested by the sight of some volcano in eruption.

There were groanings, rumblings, and detonations; rushings, hissings, splashings, and the crashing sound of breakers on the coast: but it was the surging of fiery waves upon a fiery shore. But what can I write? Such words as jets, fountains, waves, spray, convey some idea of order and regularity, but here there are none.

"The inner lake, while we stood there, formed a sort of crater within itself; the whole lava sea rose about three feet; a blowing cone about eight feet high was formed; it was never the same two minutes together. And what we saw had no existence a month before, and probably will be changed in every essential feature a month from hence. The prominent object was fire in motion; but the surface of the double lake was continually skimming over for a second or two with a cool crust of lustrous grey-white, like frost-silver, broken by jagged cracks of a bright rose-color. The movement was nearly always from the sides to the centre; but the movement of the centre itself appeared independent, and always took a southerly direction. Before each outburst of agitation there was much hissing and throbbing, with internal roaring as of imprisoned gases. Now it seemed furious, demoniacal, as if no power on earth could bind it, then playful and sportive; then for a second languid, but only because it was accumulating fresh force. Sometimes the whole lake took the form of mighty waves, and, surging heavily against the partial barrier with a sound like the Pacific surf, lashed, tore, covered it, and threw itself over it in clots of living fire. It was all confusion, commotion, forces, terror, glory, majesty, mystery, and even beauty. And the color, 'eye hath not seen' it! Molten metal hath not that crimson gleam, nor blood that living light."

To this description we may add that of Mr. Ellis, a former missionary to these islands, and one of the number who have

descended to the shores of Kilauea's abyss of fire. He says, after describing his difficult descent and progress over the lava-strewn pit:

MR. ELLIS VISITS THE LAKE OF LAVA

"Immediately before us yawned an immense gulf, in the form of a crescent, about two miles in length, from northeast to southwest; nearly a mile in width, and apparently 800 feet deep. The bottom was covered with lava, and the southwestern and northern parts of it were one vast flood of burning matter in a state of terrific ebullition, rolling to and fro its 'fiery surges' and flaming billows. Fifty-one conical islands, of varied form and size, containing as many craters, rose either round the edge or from the surface of the burning lake; twenty-two constantly emitted columns of gray smoke or pyramids of brilliant flame, and several of these at the same time vomited from their ignited mouths streams of lava, which rolled in blazing torrents down their black indented sides into the boiling mass below.

"The existence of these conical craters led us to conclude that the boiling cauldron of lava before us did not form the focus of the volcano; that this mass of melted lava was comparatively shallow, and that the basin in which it was contained was separated by a stratum of solid matter from the great volcanic abyss, which constantly poured out its melted contents through these numerous craters into this upper reservoir. The sides of the gulf before us, although composed of different strata of ancient lava, were perpendicular for about 400 feet, and rose from a wide horizontal ledge of solid black lava of irregular breadth, but extending completely round. Beneath this ledge the sides sloped gradually towards the burning lake, which was, as nearly as we could judge, 300 or 400 feet lower.

"It was evident that the large crater had been recently filled with liquid lava up to this black ledge, and had, by some subterraneous canal, emptied itself into the sea or spread under the low land on the shore. The gray and in some places apparently calcined sides of the great crater before us, the fissures which intersected the surface of the plain on which we were standing, the long banks of sulphur on the opposite side of the abyss, the vigorous action of the numerous small craters on its borders, the dense columns of vapor and smoke that rose at the north and west end of the plain, together with the ridge of steep rocks by which it was surrounded, rising probably in some places 300 or 400 feet in perpendicular height, presented an immense volcanic panorama, the effect of which was greatly augmented by the constant roaring of the vast furnaces below."

MAUNA LOA IN ERUPTION

Of the two great craters of Mauna Loa, the summit one has frequently in modern times overflowed its crest and poured its molten streams in glowing rivers over the land. This has rarely been the case with the lower and incessantly active crater of Kilauea, whose lava, when in excess, appears to escape by subterranean channels to the sea. We append descriptions of some of the more recent examples of Mauna Loa's eruptive energy. The lava from this crater does not alone flow over the crater's lip, but at times makes its way through fissures far below, the immense pressure causing it to spout in great flashing fountains high into the air. In 1852 the fiery fountains reached a height of 500 feet. In some later eruptions they have leaped 1,000 feet high. The lava is white hot as it ascends, but it assumes a blood-red tint in its fall, and strikes the ground with a frightful noise.

The quantities of lava ejected in some of the recent eruptions have been enormous. The river-like flow of 1855 was remarkable for its extent, being from two to eight miles wide, with a depth of from three to three hundred feet, and extending in a winding course for a distance of sixty miles. The Apostle of Hawaiian volcanoes, the Rev. Titus Coan, who ventured to the source of this flow while it was in supreme action, thus describes it :—

" We ascended our rugged pathway amidst steam and smoke and heat which almost blinded and scathed us. We came to open orifices down which we looked into the fiery river which rushed madly under our feet. These fiery vents were frequent, some of them measuring ten, twenty, fifty or one hundred feet in diameter. In one place we saw the river of lava uncovered for thirty rods and rushing down a declivity of from ten to twenty-five degrees. The scene was awful, the momentum incredible, the fusion perfect (white heat), and the velocity forty miles an hour. The banks on each side of the stream were red-hot, jagged and overhanging. As we viewed it rushing out from under its ebon counterpane, and in the twinkling of an eye diving again into its fiery den, it seemed to say, 'Stand off! Scan me not! I am God's messenger. A work to do. Away!' "

Later he wrote again :—" The great summit fountain is still playing with fearful energy, and the devouring stream rushes madly down toward us. It is now about ten miles distant, and heading directly for our bay. In a few days we may be called to announce the painful fact that our beauteous Hilo is no more,—that our lovely, our inimitable landscape, our emerald bowers, our crescent strand and our silver bay are blotted out. A fiery sword hangs over us. A flood of burning ruin approaches us. Devouring fires are near us. With sure and solemn progress the glowing

fusion advances through the dark forest and the dense jungle in our rear, cutting down ancient trees of enormous growth and sweeping away all vegetable life. For months the great summit furnace on Mauna Loa has been in awful blast. Floods of burning destruction have swept wildly and widely over the top and down the sides of the mountain. The wrathful stream has overcome every obstacle, winding its fiery way from its high source to the bases of the everlasting hills, spreading in a molten sea over the plains, penetrating the ancient forests, driving the bellowing herds, the wild goats and the affrighted birds before its lurid glare, leaving nothing but ebon blackness and smoldering ruin in its track."

His anticipation of the burial of Hilo under the mighty flow was happily not realized. It came to an abrupt halt while seven miles distant, the checked stream standing in a threatening and rugged ridge, with rigid, beetling front.

THE ERUPTIONS OF 1859 AND 1865

In January, 1859, Mauna Loa was again at its fire-play, throwing up lava fountains from 800 to 1,000 feet in height. From this great fiery fountain the lava flowed down in numerous streams, spreading over a width of five or six miles. One stream, probably formed by the junction of several smaller, attained a height of from twenty to twenty-five feet, and a breadth of about an eighth of a mile. Great stones were thrown up along with the jet of lava, and the volume of seeming smoke, composed probably of fine volcanic dust, is said to have risen to the height of 10,000 feet.

An eruption of still greater violence took place in 1865, characterized by similar phenomena, particularly the throwing up of jets of lava. This fiery fountain continued to play without intermission

Copyright by W. E. Scull.

LOOTERS AND ROBBERS SHOT BY THE MILITARY.

Orders were issued to the soldiers that all malefactors and robbers were to be shot on sight. The prison at Messina was wrecked to such an extent that the convicts escaped.

Copyright by W. E. Scull.

TERROR STRICKEN BY THE EARTHQUAKE.

At the first shock of the earthquake all who were not buried in the ruins of their houses fled into the squares in panic and made frantic attempts to save themselves and their belongings.

FIGHTING FOR FOOD IN THE STREETS OF MESSINA.
Earthquake and tidal wave had done their frightful work with merciless impartiality. Food was destroyed and the survivors of the first horrors were forced to battle for their existence even after they believed themselves miraculously saved from death.

MOUNT ETNA FROM THE RUINS OF TAORMINA.
Etna is the highest volcano in Europe, 10,835 feet, and the base is 87 miles in circumference.
More than 80 earthquakes of this giant fire-monster have been recorded. In
the foreground appear the ruins of the Greek theatre at Taormina
and the view is one of the most celebrated in the world.

for twenty days and nights, varying only as respects the height to which the jet arose, which is said to have ranged between 100 and 1,000 feet, the mean diameter of the jet being about 100 feet. This eruption was accompanied by explosions so loud as to have been heard at a distance of forty miles.

A cone of about 300 feet in height, and about a mile in circumference, was accumulated round the orifice whence the jet ascended. It was composed of solid matters ejected with the lava, and it continued to glow like a furnace, notwithstanding its exposure to the air. The current of lava on this occasion flowed to a distance of thirty-five miles, burning its way through the forests, and filling the air with smoke and flames from the ignited timber. The glare from the glowing lava and the burning trees together was discernible by night at a distance of 200 miles from the island.

THE LAVA FLOW OF 1880

A succeeding great lava flow was that which began on November 6, 1880. Mr. David Hitchcock, who was camping on Mauna Kea at the time of this outbreak, saw a spectacle that few human eyes have ever beheld. "We stood," writes he, "on the very edge of that flowing river of rock. Oh, what a sight it was! Not twenty feet from us was this immense bed of rock slowly moving forward with irresistible force, bearing on its surface huge rocks and immense boulders of tons' weight as water would carry a toy-boat. The whole front edge was one bright red mass of solid rock incessantly breaking off from the towering mass and rolling down to the foot of it, to be again covered by another avalanche of white-hot rocks and sand. The whole mass at its front edge was from twelve to thirty feet in height. Along the entire line of its advance it was one crash of rolling, sliding, tumbling red-hot rock. We could hear

no explosions while we were near the flow, only a tremendous roaring like ten thousand blast furnaces all at work at once."

This was the most extensive flow of recent years, and its progress from the interior plain through the dense forests above Hilo and out on to the open levels close to the town was startling and menacing enough. Through the woods especially it was a turbulent, seething mass that hurled down mammoth trees, and licked up streams of water, and day and night kept up an unintermitting cannonade of explosions. The steam and imprisoned gases would burst the congealing surface with loud detonations that could be heard for many miles. It was not an infrequent thing for parties to camp out close to the flow over night. Ordinarily a lava-flow moves sluggishly and congeals rapidly, so that what seems like hardihood in the narrating is in reality calm judgment, for it is perfectly safe to be in the close vicinity of a lava-stream, and even to walk on its surface as soon as one would be inclined to walk on cooling iron in a foundry. This notable flow finally ceased within half a mile of Hilo, where its black form is a perpetual reminder of a marvellous deliverance from destruction.

KILAUEA IN 1840

Kilauea seems never, in historic times, to have filled and overflowed its vast crater. To do so would need an almost inconceivable volume of liquid rock material. But it approached this culmination in 1840, when it became, through its whole extent, a raging sea of fire. The boiling lava rose in the mighty mountain-cup to a height of from 500 to 600 feet. Then it forced a passage through a subterranean cavity twenty-seven miles long, and reached the sea, forty miles distant, in two days. The stream where it fell into the sea was half a mile wide, and the flow kept up for three weeks, heating

the ocean twenty miles from land. An eye-witness of this extraordinary flow thus describes it:

"When the torrent of fire precipitated itself into the ocean, the scene assumed a character of terrific and indescribable grandeur. The magnificence of destruction was never more perceptibly displayed than when these antagonistic elements met in deadly strife. The mightiest of earth's magazines of fire poured forth its burning billows to meet the mightiest of oceans. For two score miles it came rolling, tumbling, swelling forward, an awful agent of death. Rocks melted like wax in its path; forests crackled and blazed before its fervent heat; the works of man were to it but as a scroll in the flames. Imagine Niagara's stream, above the brink of the Falls, with its dashing, whirling, madly-raging waters hurrying on to their plunge, instantaneously converted into fire; a gory-hued river of fused minerals; volumes of hissing steam arising; some curling upward from ten thousand vents, which give utterance to as many deep-toned mutterings, and sullen, confined clamorings; gases detonating and shrieking as they burst from their hot prison-house; the heavens lurid with flame; the atmosphere dark and oppressive; the horizon murky with vapors and gleaming with the reflected contest!

"Such was the scene as the fiery cataract, leaping a precipice of fifty feet, poured its flood upon the ocean. The old line of coast, a mass of compact, indurated lava, whitened, cracked and fell. The waters recoiled, and sent forth a tempest of spray; they foamed and dashed around and over the melted rock, they boiled with the heat, and the roar of the conflicting agencies grew fiercer and louder. The reports of the exploding gases were distinctly heard twenty-five miles distant, and were likened to a whole broadside of heavy artillery. Streaks of the intensest light glanced like

lightning in all directions; the outskirts of the burning lava as it fell, cooled by the shock, were shivered into millions of fragments, and scattered by the strong wind in sparkling showers far into the country. For three successive weeks the volcano disgorged an uninterrupted burning tide, with scarcely any diminution, into the ocean. On either side, for twenty miles, the sea became heated, with such rapidity that, on the second day of the junction of the lava with the ocean, fishes came ashore dead in great numbers, at a point fifteen miles distant. Six weeks later, at the base of the hills, the water continued scalding hot, and sent forth steam at every wash of the waves."

THE SINKING OF KILAUEA'S FIRE-LAKE

In 1866 the great crater of Kilauea presented a new and unlooked-for spectacle in the sinking and vanishing of its great lava lake. In March of that year the fires in the ancient cauldron totally disappeared, and the surrounding lava rock sank to a depth of nearly 600 feet. Mr. Thrum, in a pamphlet on "The Suspended Activity of Kilauea," says of it:

"Distant rumbling noises were heard, accompanied by a series of earthquakes, forty-three in number. With the fourth shock the brilliancy of New Lake disappeared, and towards 3 A. M. the fires in Halemaumau disappeared also, leaving the whole crater in darkness.

"With the dawn the shocks and noises ceased, and revealed the changes which Kilauea had undergone in the night. All the high cliffs surrounding Halemaumau and New Lake, which had become a prominent feature in the crater, had vanished entirely, and the molten lava of both lakes had disappeared by some subterranean passage from the bottom of Halemaumau. There was no material

change in the sunken portion of the crater except a continual falling in of rocks and debris from its banks as the contraction from its former intense heat loosened their compactness and sent them hurling some 200 or 300 feet below, giving forth at times a boom as of distant thunder, followed by clouds of cinders and ashes shooting up into the air 100 to 300 feet, proportionate, doubtless, to the size of the newly fallen mass."

This remarkable recession of the liquid lava in Halemaumau was probably due to the opening of some deep subterranean passage through which the lake of lava made its way unseen to the ocean's depths. The Rev. Mr. Baker, probably the most adventuresome explorer of Hawaiian volcanoes, actually descended into that crumbling pit to a point within what he judged to be fifty feet of the bottom. But Halemaumau had only taken an intermission, for in two short months signs of returning life became frequent and unmistakable, and, in June, culminated in the sudden outbreak of a lake that has since then steadily increased in activity.

THE GODDESS PELE

We cannot close this chapter without some reference to the Goddess Pele, to whom the Hawaiians long imputed the wonder work of their volcanic mountains. When there is unusual commotion in Kilauea myriads of thread-like filaments float in the air and fall upon the cliffs, making deposits much resembling matted hair. A single filament over fifteen inches long was picked up on a Hilo veranda, having sailed in the air a distance of fifty miles This is the famous Pele's Hair, being the glass-like product of volcanic fires. It resembles Prince Rupert's Drops, and the tradition is that whenever the volcano becomes active it is because Pele, the Goddess of the crater, emerges from her fiery furnace and shakes her vitreous locks in anger.

This fabled being, according to Emerson, in a paper on "The Lesser Hawaiian Gods," "could at times assume the appearance of a handsome young woman, as when Kamapuaa, to his cost, was smitten with her charms when first he saw her with her sisters at Kilauea." Kamapauaa was a gigantic hog, who "could appear as a handsome young man, a hog, a fish or a tree." "At other times the innate character of the fury showed itself, and Pele appeared in her usual form as an ugly and hateful old hag, with tattered and fire-burnt garments, scarcely concealing the filth and nakedness of her person. Her bloodshot eyes and fiendish countenance paralized the beholder, and her touch turned him to stone. She was a jealous and vindictive monster, delighting in cruelty, and at the slightest provocation overwhelming the unoffending victims of her rage in widespread ruin."

The superstition regarding the Goddess Pele was thought to have received a death blow in 1825, when Kapiolani, an Hawaiian princess and a Christian convert, ascended, with numerous attendants, to the crater of Kilauea, where she publicly defied the power and wrath of the goddess. No response came to her defiance, she descended in safety, and faith in Pele's power was widely shaken.

Yet as late as 1887 the old superstition revived and claimed an exalted victim, for in that year the Princess Like Like, the youngest sister of the king, starved herself to death to appease the anger of the Goddess Pele, supposed to be manifested in Mauna Loa's eruption of that year, and to be quieted only by the sacrifice of a victim of royal blood. Thus slowly do the old superstitions die away.

CHAPTER XXVIII.

Popocatapetl and Other Volcanoes of Mexico and Central America.

MEXICO is very largely a vast table-land, rising through much of its extent to an elevation of from 7,000 to 8,000 feet above sea-level, and bounded east and west by wide strips of torrid lowlands adjoining the oceans. It is crossed at about 19° north latitude by a range of volcanic mountains, running in almost a straight line east and west, upon which are several extinct volcanic cones, and five active or quiescent volcanoes. The highest of these is Popocatapetl, south of the city of Mexico and nearly midway between the Atlantic and Pacific.

East of this mountain lies Orizabo, little below it in height, and San Martin or Tuxtla, 9,700 feet high, on the coast south of Vera Cruz. West of it is Jorullo, 4,000 feet, and Colima, 12,800, near the Pacific coast. The volcanic energy continues southward toward the Isthmus, but decreases north of this volcanic range. These mountains have shown little signs of activity in recent times. Popocatapetl emits smoke, but there is no record of an eruption since 1540. Orizabo has been quiet since 1566. Tuxtla had a violent eruption in 1793, but since then has remained quiescent. Colima is the only one now active. For ten years past it has been emitting ashes and smoke. The most remarkable of these volcanoes is Jorullo, which closely resembled Monte Nuovo, described in Chapter XIII., in its mode of origin.

Popocatepetl, the hill that smokes, in the Mexican language, the huge mountain clothed in eternal snows, and regarded by the idolators of old as a god, towers up nearly 18,000 feet above the level of the sea, and in the days of the conquest of Mexico was a volcano in a state of fierce activity. It was looked upon by the natives with a strange dread, and they told the white strangers with awe that no man could attempt to ascend its slopes and yet live; but, from a feeling of vanity, or the love of adventure, the Spaniards laughed at these fears, and accordingly a party of ten of the followers of Cortes commenced the ascent, accompanied by a few Indians. But these latter, after ascending about 13,000 feet to where the last remains of stunted vegetation existed, became alarmed at the subterranean bellowings of the volcano, and returned, while the Spaniards still painfully toiled on through the rarefied atmosphere, their feet crushing over the scoriæ and black-glazed volcanic sand, until they stood in the region of perpetual snow, amidst the glittering, treacherous glaciers and crevasses, with vast slippery-pathed precipices yawning round.

Still they toiled on in this wild and wondrous region. A few hours before they were in a land of perpetual summer; here all was snow. They suffered the usual distress awarded to those who dare to ascend to these solitudes of nature but it was not given to them to achieve the summit, for suddenly, at a higher elevation, after listening to various ominous threatenings from the interior of the volcano, they encountered so fierce a storm of smoke, cinders, and sparks, that they were driven back half suffocated to the lower portions of the mountain.

Some time after another attempt was made; and upon this occasion with a definite object. The invaders had nearly exhausted their stock of gunpowder, and Cortes organized a party to ascend

to the crater of the volcano, to seek and bring down sulphur for the manufacture of this necessary of warfare. This time the party numbered but five, led by one Francisco Montano; and they experienced no very great difficulty in winning their way upwards. The region of verdure gave place to the wild, lava-strewn slope, which was succeeded in its turn by the treacherous glaciers; and at last the gallant little band stood at the very edge of the crater, a vast depression of over a league in circumference, and 1,000 feet in depth.

SULPHUR FROM THE CRATER

Flame was issuing from the hideous abysses, and the stoutest man's heart must have quailed as he peered down into the dim, mysterious cavity to where the sloping sides were crusted with bright yellow sulphur, and listened to the mutterings which warned him of the pent-up wrath and power of the mighty volcano. They knew that at any moment flame and stifling sulphurous vapor might be belched forth, but now no cowardice was shown. They had come provided with ropes and baskets, and it only remained to see who should descend. Lots were therefore drawn, and it fell to Montano, who was accordingly lowered by his followers in a basket 400 feet into the treacherous region of eternal fires.

The basket swayed and the rope quivered and vibrated, but the brave cavalier sturdily held to his task, disdaining to show fear before his humble companions. The lurid light from beneath flashed upon his tanned features, and a sulphurous steam rose slowly and condensed upon the sides; but, whatever were his thoughts, the Spaniard collected as much sulphur as he could take up with him, breaking off the bright incrustations, and even dallying with his task as if in contempt of the danger, till he had leisurely filled his basket, when the signal was given and he was drawn up.

The basket was emptied, and then he once more descended into the lurid crater, collected another store and was again drawn up; but far from shrinking from his task, he descenced again several times, till a sufficiency had been obtained, with which the party descended to the plain.

THE VOLCANO JORULLO

No further back than the middle of the eighteenth century the site of Jorullo was a level plain, including several highly-cultivated fields, which formed the farm of Don Pedro di Jorullo. The plain was watered by two small rivers, called Cuitimba and San Pedro, and was bounded by mountains composed of basalt—the only indications of former volcanic action. These fields were well irrigated, and among the most fertile in the country, producing abundant crops of sugar-cane and indigo.

In the month of June, 1759, the cultivators of the farm began to be disturbed by strange subterranean noises of an alarming kind, accompanied by frequent shocks of earthquake, which continued for nearly a couple of months; but they afterward entirely ceased, so that the inhabitants of the place were lulled into security. On the night between the 28th and 29th of September, however, the subterranean noises were renewed with greater loudness than before, and the ground shook severely. The Indian servants living on the place started from their beds in terror, and fled to the neighboring mountains. Thence gazing upon their master's farm they beheld it, along with a tract of ground measuring between three and four square miles, in the midst of which it stood, rise up bodily, as if it had been inflated from beneath like a bladder. At the edges this tract was uplifted only about 39 feet above the original surface, but so great was its convexity that toward the middle it attained a height of no less than 524 feet.

The Indians who beheld this strange phenomenon declared that they saw flames issuing from several parts of this elevated tract, that the entire surface became agitated like a stormy sea, that great clouds of ashes, illuminated by volcanic fires glowing beneath them, rose at several points, and that white-hot stones were thrown to an immense height. Vast chasms were at the same time opened in the ground, and into these the two small rivers above

JORULLO, THE GREAT MEXICAN VOLCANO

mentioned plunged. Their waters, instead of extinguishing the subterranean conflagration, seemed only to add to its intensity. Quantities of mud, enveloping balls of basalt, were then thrown up, and the surface of the elevated ground became studded with small cones, from which volumes of dense vapor, chiefly steam, were emitted, some of the jets rising from 20 to 30 feet in height.

These cones the Indians called ovens, and in many of them was long heard a subterranean noise resembling that of water

briskly boiling. Out of a great chasm in the midst of those ovens there were thrown up six larger elevations, the highest being 1,640 feet above the level of the plain, 4,315 above sea level, and now constituting the principal volcano of Jorullo. The smallest of the six was 300 feet in height; the others of intermediate elevation The highest of these hills had on its summit a regular volcanic crater, whence there have been thrown up great quantities of dross and lava, containing fragments of older rocks. The ashes were transported to immense distances, some of them having fallen on the houses at Queretaro, more than forty-eight leagues from Jorullo. The volcano continued in this energetic state of activity for about four months; in the following years its eruptions became less frequent, but it still continues to emit volumes of vapor from the principal crater, as well as from many of the ovens in the upheaved ground.

EFFECT ON THE RIVERS

The two rivers, which disappeared on the first night of this great eruption, now pursue an underground course for about a mile and a quarter, and then reappear as hot springs, with a temperature of 126° F.

This wonderful volcanic upheaval is all the more remarkable, from the inland situation of the plain on which it occurred, it being no less than 120 miles distant from the nearest ocean, while there is no other volcano nearer to it than 80 miles. The activity of the ovens has now ceased, and portions of the upheaved plain on which they are situated have again been brought under cultivation, and the volcano is in a state of quiescence.

The crater of Popocatepetl, which towers to a height of 17,000 feet, is a vast circular basin, whose nearly vertical walls are in some parts of a pale rose tint, in others quite black. The

bottom contains several small fuming cones, whence arise vapors of changeable color, being successively red, yellow and white. All round them are large deposits of sulphur, which are worked for mercantile purposes.

Orizaba has a little less lofty snow-clad peak. This mountain was in brisk volcanic activity from 1545 to 1560, but has since then relapsed into a prolonged repose. It was climbed, in 1856, by Baron Müller, to whose mind the crater appeared like the entrance to a lower world of horrible darkness. He was struck with astonishment on contemplating the tremendous forces required to elevate and rend such enormous masses—to melt them, and then pile them up like towers, until by cooling they became consolidated into their present forms. The internal walls of the crater are in many places coated with sulphur, and at the bottom are several small volcanic craters. At the time of his visit the summit was wholly covered with snow, but the Indians affirmed that hot vapors occasionally ascend from fissures in the rocks. Since then others have reached its summit, among them Angelo Heilprin, the first to gaze into the crater of Mont Pelee after its eruption.

ERUPTIONS IN NICARAGUA

On the 14th of November, 1867, there commenced an eruption from a mountain about eight leagues to the eastward of the city of Leon, in Nicaragua. This mountain does not appear to have been previously recognized as an active volcano, but it is situated in a very volcanic country. The outburst had probably some connection with the earthquake at St. Thomas, which took place on the 18th of November following. The mountain continued in a state of activity for about sixteen days. There was thrown out an immense quantity of black sand, which was carried as far as to the coast of

the Pacific, fifty miles distant. Glowing stones were projected from the crater to an estimated height of three thousand feet.

Central America is more prolific of volcanoes than Mexico, and the State of Guatemala in particular. One authority credits this State with fifteen or sixteen and another with more than thirty volcanic cones. Of these at least five are decidedly active. Tajumalco, which was in eruption at the time of the great earthquake of 1863, yields great quantities of sulphur, as also does Quesaltenango. The most famous is the Volcan de Agua (Water Volcano), so called from its overwhelming the old city of Guatemala with a torrent of water in 1541.

Nicaragua is also rich in volcanoes, being traversed its entire length by a remarkable chain of isolated volcanic cones, several of which are to some extent active. We have already told the story of the tremendous eruption of Coseguina in 1835, one of the most violent of modern times. The latest important eruption here was that of Ometepec, a volcanic mount on an island of the same name in Lake Nicaragua. This broke a long period of repose on June 19, 1883, with a severe eruption, in which the lava, pouring from a new crater, in seven days overflowed the whole island and drove off its population. Incessant rumblings and earthquake shocks accompanied the eruption, and mud, ashes, stones and lava covered the mountain slopes, which had been cultivated for many centuries. These were the most recent strong displays of volcanic energy in Central America, though former great outflows of lava are indicated by great fields of barren rock, which extend for miles.

CHAPTER XXIX.

The Terrible Eruption of Krakatoa.

THE most destructive volcanic explosion of recent times one perhaps unequalled in violence in all times, was that of the small mountain island of Krakatoa, in the East Indian Archipelago, in 1883. This made its effects felt round the entire globe, and excited such wide attention that we feel called upon to give it a chapter of its own.

The island of Krakatoa lies in the Straits of Sunda, between Java and Sumatra. In size it is insignificant, and had been silent so long that its volcanic character was almost lost sight of. Of its early history we know nothing. At some remote time in the past it may have appeared as a large cone, of some twenty-five miles in circumference at base and not less than 10,000 feet high. Then, still in unknown times, its cone was blown away by internal forces, leaving only a shattered and irregular crater ring. This crater was two or three miles in diameter, while the highest part of its walls rose only a few hundred feet above the sea. Later volcanic work built up a number of small cones within the crater, and still later a new cone, called Rakata, rose on the edge of the old one to a height of 2,623 feet.

The first known event in the history of the island volcano was an eruption in the year 1680. After that it lay in repose, forming a group of islands, one much larger than the others. Some of the smaller islands indicated the rim of the old crater, much of which

was buried under the sea. Its state of quiescence continued for two centuries, a tropical vegetation richly mantled the island, and to all appearance it had sunk permanently to rest.

Indications of a coming change appeared in 1880, in the form of earthquakes, which shook all the region around. These continued at intervals for more that two years. Then, on May 20, 1883, there were heard at Batavia, a hundred miles away, "booming sounds like the firing of artillery." Next day the captain of a vessel passing through the Straits saw that Krakatoa was in eruption, sending up clouds of smoke and showers of dust and pumice. The smoke was estimated to reach a height of seven miles, while the volcanic dust drifted to localities 300 miles away.

AWFUL PREMONITIONS

The mountain continued to play for about fourteen weeks with varying activity, several parties meanwhile visiting it and making observations. Such an eruption, in ordinary cases, would have ultimately died away, with no marked change other than perhaps the ejection of a stream of lava. But such was not now the case. The sequel was at once unexpected and terrible. As the island was uninhabited, no one actually saw what took place, those nearest to the scene of the eruption having enough to do to save their own lives, while the dense clouds of vapor and dust baffled observation.

The phase of greatest violence set in on Sunday, August 26th. Soon after midday sailors on passing ships saw that the island had vanished behind a dense cloud of black vapor, the height of which was estimated at not less than seventeen miles. At intervals frightful detonations resounded, and after a time a rain of pumice began to fall at places ten miles distant. For miles round fierce flashes

of lightning rent the vapor, and at a distance of fully forty miles ghostly corposants gleamed on the rigging of a vessel.

These phenomena grew more and more alarming until August 27th, when four explosions of fearful intensity shook earth and sea and air, the third being "far the most violent and productive of the most widespread results." It was, in fact, perhaps the most tremendous volcanic outburst, in its intensity, known in human history. It seemed to overcome the obstruction to the energy of the internal forces, for the eruption now declined, and in a day or two practically died away, though one or two comparatively insignificant outbursts took place later.

FAR-REACHING DESTRUCTION

The eruption spread ruin and death over many surrounding leagues. At Krakotoa itself, when men once more reached its shores, everything was found to be changed. About two-thirds of the main island were blown completely away. The marginal cone was cut nearly in half vertically, the new cliff falling precipitously toward the centre of the crater. Where land had been before now sea existed, in some places more than one hundred feet deep. But the part of the island that remained had been somewhat increased in size by ejected materials.

Of the other islands and islets some had disappeared; some were partially destroyed; some were enlarged by fallen debris, while many changes had taken place in the depth of the neighboring sea-bed. Two new islands, Steers and Calmeyer, were formed. The ejected pumice, so cavernous in structure as to float upon the water, at places formed great floating islands which covered the sea for miles, and sometimes rose from four to seven feet above it, proving a serious obstacle to navigation. On vessels near by dust fell to

the depth of eighteen inches. The enormous clouds of volcanic dust which had been flung high into the air darkened the sky for a great area around. At Batavia, about a hundred miles from the volcano, it produced an effect not unlike that of a London fog. This began about seven in the morning of August 27th. Soon after ten the light had become lurid and yellow, and lamps were required in the houses; then came a downfall of rain, mingled with dust, and by about half-past eleven the town was in complete darkness. It soon after began to lighten, and the rain to diminish, and about three o'clock it had ceased.

At Buitenzorg, twenty miles further away, the conditions were similar, but lasted for a shorter time. In places much farther away the upper sky presented a strangely murky aspect, and the sun assumed a green color. Phenomena of this kind were traced over a broad area of the globe, even as far as the Hawaiian Islands, while over a yet wider area the sky after sunset was lit up by after-glows of extraordinary beauty. The height to which the dust was projected has been calculated from various data, with the result that 121,500 feet, or nearly 25 miles, is thought to be a probable maximum estimate, though it may be that occasional fragments of larger size were shot up to a still greater height.

A GRAPHIC DESCRIPTION OF THE ERUPTION

Another effect, of a distressing character, followed the eruption. A succession of enormous waves, emanating from Krakatoa, traversed the sea, and swept the coast bordering the Straits of Sunda with such force as to destroy many villages on the low-lying shores in Java, Sumatra and other islands. Some buildings at a height of fifty feet above sea-level were washed away, and in some places the water rose higher, in one place reaching the height of

115 feet. At Telok Betong, in Sumatra, a ship was carried inland a distance of nearly two miles, and left stranded at a height of thirty feet above the sea.

The eruption of Krakatoa seems to have been due to some deep-lying causes of extraordinary violence, this appearing not only in the terrible explosion which tore the island to fragments and sent its remnants as floating dust many miles high into the air, but also from an internal convulsion that affected many of the volcanoes of Java, which almost simultaneously broke into violent eruption. We extract from Dr. Robert Bonney's "Our Earth and its Story" a description of these closely-related events.

"The disturbances originated on the island of Krakatoa, with eruptions of red hot stones and ashes, and by noon next day Semeru, the largest of the Javanese volcanoes, was reported to be belching forth flames at an alarming rate. The eruption soon spread to Gunung Guntur and other mountains, until more than a third of the forty-five craters of Java were either in activity or seriously threatening it.

"Just before dusk a great cloud hung over Gunung Guntur, and the crater of the volcano began to emit enormous streams of white sulphurous mud and lava, which were rapidly succeeded by explosions, followed by tremendous showers of cinders and enormous fragments of rock, which were hurled high into the air and scattered in all directions, carrying death and destruction with them. The overhanging clouds were, moreover, so charged with electricity that water-spouts added to the horror of the scene. The eruption continued all Saturday night, and next day a dense cloud, shot with lurid red, gathered over the Kedang range, intimating that an eruption had broken out there.

"This proved to be the case, for soon after streams of lava poured down the mountain sides into the valleys, sweeping everything before them. About two o'clock on Monday morning—we are drawing on the account of an eye-witness—the great cloud suddenly broke into small sections and vanished. When light came it was seen that an enormous tract of land, extending from Point Capucin on the south, and Negery Passoerang on the north and west, to the lowest point, covering about fifty square miles, had been temporarily submerged by the 'tidal wave.' Here were situated the vilages of Negery and Negery Babawang. Few of the inhabitants of these places escaped death. This section of the island was less densely populated than the other portions, and the loss of life was comparatively small, although it must have aggregated several thousands. The waters of Welcome Bay in the Sunda Straits, Pepper Bay on the east, and the Indian Ocean on the south, had rushed in and formed a sea of turbulent waves.

DETONATIONS HEARD FOR MANY MILES AWAY

"On Monday night the volcano of Papandayang was in an active state of paroxysmal eruption, accompanied by detonations which are said to have been heard for many miles away. In Sumatra three distinct columns of flame were seen to rise from a mountain to a vast height, and its whole surface was soon covered with fiery lava streams, which spread to great distances on all sides. Stones fell for miles around, and black fragmentary matter carried into the air caused total darkness. A whirlwind accompanied the eruption, by which house-roofs, trees, men, and horses were swept into the air. The quantity of matter ejected was such as to cover the ground and the roofs of the houses at Denamo to the depth of several inches. Suddenly the scene changed. At first it was

reported that Papandayang had been split into seven distinct peaks. This proved untrue; but in the open seams formed could be seen great balls of molten matter. From the fissures poured forth clouds of steam and black lava, which, flowing in steady streams, ran slowly down the mountain sides, forming beds 200 or 300 feet in extent. At the entrance to Batavia was a large group of houses extending along the shore, and occupied by Chinamen. This portion of the city was entirely destroyed, and not many of the Chinese who lived on the swampy plains managed to save their lives. They stuck to their homes till the waves came and washed them away, fearing torrents of flame and lava more than torrents of water.

"Of the 3,500 Europeans and Americans in Batavia—which for several hours was in darkness, owing to the fall of ashes—800 perished at Anjer. The European and American quarter was first overwhelmed by rocks, mud and lava from the crater, and then the waters came up and swallowed the ruins, leaving nothing to mark the site, and causing the loss of about 200 lives of the inhabitants and those who sought refuge there."

The loss of life above mentioned was but a small fraction of the total loss. All along the coasts of the adjoining large islands towns and villages were swept away and their inhabitants drowned, till the total loss was, as nearly as could be estimated, 36,000 souls. Krakatoa thus surpassed Mont Pelee in its tale of destruction. These two, indeed, have been the most destructive to life of known volcanic explosions, since the volcano usually falls far short of the earthquake in its murderous results.

The distant effects of this explosion were as remarkable as the near ones. The concussion of the air reached to an unprecedented distance and the clouds of floating dust encircled the earth,

producing striking phenomena of which an account is given at the end of this chapter.

The rapidity with which the effects of the Krakatoa eruption made themselves evident in all parts of the earth is perhaps the most remarkable outcome of this extraordinary event. The floating pumice reached the harbor of St. Paul on the 22nd of March, 1884, after having made a voyage of some two hundred and sixty days at a rate of six-tenths of a mile an hour. Immense quantities of pumice of a similar description, and believed to have been derived from the same source, reached Tamatave in Madagascar five months later, and no doubt much of it long continued to float round the world.

SERIES OF ATMOSPHERIC WAVES

Another result of the eruption was the series of atmospheric waves, caused by the disturbance in the atmosphere, which affected the barometer over the entire world. The velocity with which these waves traveled has been variously estimated at from 912.09 feet to 1066.29 feet per second. This speed is, of course, very much inferior to that at which sound travels through the air. Yet, in three distinct cases, the noise of the Krakatao explosions was plainly heard at a distance of at least 2,200 miles, and in one instance—that recorded from Rodriguez—of nearly 3,000. The sound travelled to Ceylon, Burmah, Manila, New Guinea and Western Australia, places, however, within a radius of about 2,000 miles; out Diego Garcia lies outside that area, and Rodriguez a thousand miles beyond it. Six days subsequent to the explosion, after the atmospheric waves had traveled four times round the globe, the barometer was still affected by them.

Another result, similar in kind, was the extraordinary dissemination of the great ocean wave, which in a like manner seems to have

encircled the earth, since high waves, without evident cause, appeared not only in the Pacific, but at many places on the Atlantic coast within a few days after the event. They were observed alike in England and at New York. The writer happened to be at Atlantic City, on the New Jersey coast, at this time. It was a period of calm, the winds being at rest, but, unheralded, there came in an ocean wave of such height as to sweep away the ocean-front boardwalk and do much other damage. He ascribed this strange wave at the time to the Krakatoa explosion, and is of the same opinion still.

In addition to the account given of this extraordinary volcanic event, it seems desirable to give Sir Robert S. Ball's description of it in his recent work, "The Earth's Beginnings." While repeating to some extent what we have already said, it is worthy, from its freshness of description and general readability, of a place here.

SIR ROBERT S. BALL'S DESCRIPTION

"Until the year 1883 few had ever heard of Krakatoa. It was unknown to fame, as are hundreds of other gems of glorious vegetation set in tropical waters. It was not inhabited, but the natives from the surrounding shores of Sumatra and Java used occasionally to draw their canoes up on its beach, while they roamed through the jungle in search of the wild fruits that there abounded. It was known to the mariner who navigated the Straits of Sunda, for it was marked on his charts as one of the perils of the intricate navigation in those waters. It was no doubt recorded that the locality had been once, or more than once, the seat of an active volcano. In fact, the island seemed to owe its existence to some frightful eruption of by-gone days; but for a couple of centuries there had been no fresh outbreak. It almost seemed as if

Krakatoa might be regarded as a volcano that had become extinct. In this respect it would only be like many other similar objects all over the globe, or like the countless extinct volcanoes all over the moon.

"As the summer of 1883 advanced the vigor of Krakatoa, which had sprung into notoriety at the beginning of the year, steadily increased and the noises became more and more vehement; these were presently audible on shores ten miles distant, and then twenty miles distant; and still those noises waxed louder and louder, until the great thunders of the volcano, now so rapidly developing, astonished the inhabitants that dwelt over an area at least as large as Great Britain. And there were other symptoms of the approaching catastrophe. With each successive convulsion a quantity of fine dust was projected aloft into the clouds. The wind could not carry this dust away as rapidly as it was hurled upward by Krakatoa, and accordingly the atmosphere became heavily charged with suspended particles.

"A pall of darkness thus hung over the adjoining seas and islands. Such was the thickness and density of these atmospheric volumes of Krakatoa dust that, for a hundred miles around, the darkness of midnight prevailed at midday. Then the awful tragedy of Krakatoa took place. Many thousands of the unfortunate inhabitants of the adjacent shores of Sumatra and Java were destined never to behold the sun again. They were presently swept away to destruction in an invasion of the shore by the tremendous waves with which the seas surrounding Krakatoa were agitated.

"As the days of August passed by the spasms of Krakatoa waxed more and more vehement. By the middle of that month the panic was widespread, for the supreme catastrophe was at hand. On the night of Sunday, August 26, 1883, the blackness of the

dust-clouds, now much thicker than ever in the Straits of Sunda and adjacent parts of Sumatra and Java, was only occasionally illumined by lurid flashes from the volcano.

"At the town of Batavia, a hundred miles distant, there was no quiet that night. The houses trembled with subterranean violence, and the windows rattled as if heavy artillery were being discharged in the streets. And still these efforts seemed to be only rehearsing for the supreme display. By ten o'clock on the morning of Monday, August 27, 1883, the rehearsals were over, and the performance began. An overture, consisting of two or three introductory explosions, was succeeded by a frightful convulsion which tore away a large part of the island of Krakatoa and scattered it to the winds of heaven. In that final outburst all records of previous explosions on this earth were completely broken.

AN EXTRAORDINARY NOISE

"This supreme effort it was which produced the mightest noise that, so far as we can ascertain, has ever been heard on this globe. It must have been indeed a loud noise which could travel from Krakatoa to Batavia and preserve its vehemence over so great a distance; but we should form a very inadequate conception of the energy of the eruption of Krakatoa if we thought that its sounds were heard by those merely a hundred miles off. This would be little indeed compared with what is recorded on testimony which it is impossible to doubt.

"Westward from Krakatoa stretches the wide expanse of the Indian Ocean. On the opposite side from the Straits of Sunda lies the island of Rodriguez, the distance from Krakatoa being almost three thousand miles. It has been proved by evidence which cannot be doubted that the thunders of the great volcano attracted the

attention of an intelligent coast-guard on Rodriguez, who carefully noted the character of the sounds and the time of their occurrence He had heard them just four hours after the actual explosion, for this is the time the sound occupied on its journey.

A CONSTANT WIND

"This mighty incident at Krakatoa has taught us other lessons on the constitution of our atmosphere. We previously knew little, or I might say almost nothing, as to the conditions prevailing above the height of ten miles overhead. It was Krakatoa which first gave us a little information which was greatly wanted. How could we learn what winds were blowing at a height four times as great as the loftiest mountain on the earth, and twice as great as the loftiest altitude to which a balloon has ever soared? No doubt a straw will show which way the wind blows, but there are no straws up there. There was nothing to render the winds perceptible until Krakatoa came to our aid. Krakatoa drove into those winds prodigious quantities of dust. Hundreds of cubic miles of air were thus deprived of that invisibility which they had hitherto maintained.

"With eyes full of astonishment men watched those vast volumes of Krakatoa dust on a tremendous journey. Of course, every one knows the so-called trade-winds on our earth's surface, which blow steadily in fixed directions, and which are of such service to the mariner. But there is yet another constant wind. It was first disclosed by Krakatoa. Before the occurrence of that eruption, no one had the slightest suspicion that far up aloft, twenty miles over our heads, a mighty tempest is incessantly hurrying, with a speed much greater than that of the awful hurricane which once laid so large a part of Calcutta on the ground and slew so many of its

inhabitants. Fortunately for humanity, this new trade-wind does not come within less than twenty miles of the earth's surface. We are thus preserved from the fearful destruction that its unintermittent blasts would produce, blasts against which no tree could stand, and which would, in ten minutes, do as much damage to a city as would the most violent earthquake. When this great wind had become charged with the dust of Krakatoa, then, for the first, and, I may add, for the only time, it stood revealed to human vision. Then it was seen that this wind circled round the earth in the vicinity of the equator, and completed its circuit in about thirteen days.

A VAST CLOUD OF DUST

"The dust manufactured by the supreme convulsion was whirled round the earth in the mighty atmospheric current into which the volcano discharged it. As the dust-cloud was swept along by this incomparable hurricane it showed its presence in the most glorious manner by decking the sun and the moon in hues of unaccustomed splendor and beauty. The blue color in the sky under ordinary circumstances is due to particles in the air, and when the ordinary motes of the sunbeam were reinforced by the introduction of the myriads of motes produced by Krakatoa even the sun itself sometimes showed a blue tint. Thus the progress of the great dust-cloud was traced out by the extraordinary sky effects it produced, and from the progress of the dust-cloud we inferred the movements of the invisible air current which carried it along. Nor need it be thought that the quantity of material projected from Krakatoa should have been inadequate to produce effects of this world-wide description. Imagine that the material which was blown to the winds of heaven by the supreme convulsion of Krakatoa could be all recovered and swept into one vast heap. Imagine

that the heap were to have its bulk measured by a vessel consisting of a cube one mile long, one mile broad and one mile deep; it has been estimated that even this prodigious vessel would have to be filled to the brim at least ten times before all the products of Krakatoa had been measured."

It is not specially to the quantity of material ejected from Krakatoa that it owes its reputation. Great as it was, it has been much surpassed. Professor Judd says that the great eruptions of Papapandayang, in Java, in 1772, of Skaptur Jökull, in Iceland, in 1783, and of Tamboro, in Sumbawa, in 1815, were marked by the extrusion of much larger quantities of material. The special feature of the Krakatoa eruption was its extreme violence, which flung volcanic dust to a height probably never before attained, and produced sea and air waves of an intensity unparalleled in the records of volcanic action. Judd thinks this was due to the situation of the crater, and the possible inflow through fissures of a great volume of sea water to the interior lava, the result being the sudden production of an enormous volume of steam.

EXTRAORDINARY RED SUNSETS

The red sunsets spoken of above were so extraordinary in character that a fuller description of them seems advisable. A remarkable fact concerning them is the great rapidity with which they were disseminated to distant regions of the earth. They appeared around the entire equatorial zone in a few days after the eruption, this doubtless being due to the great rapidity with which the volcanic dust was carried by the upper air current. They were seen at Rodriguez, 3,000 miles away, on August 28, and within a week in every part of the torrid zone. From this zone they spread north and south with less rapidity. Their first appearance in Australia was on September 15th, and at the Cape of Good Hope on

the 20th. On the latter day they were observed in California and the Southern United States. They were first seen in England on November 9th. Elsewhere in Europe and the United States they appeared from November 20th to 30th.

The effect lasted in some instances as long as an hour and three-quarters after sunset. In India the sun and skies assumed a greenish hue, and there was much curiosity regarding the cause of the "green sun." Another remarkable phenomenon of this period was the great prevalence of rain during the succeeding winter. This probably was due to the same cause; that is, to the fact of the air being so filled with dust; the prevailing theory in regard to rain being that the existence of dust in the air is necessary to its fall. The vapor of the air concentrates into drops around such minute particles, the result being that where dust is absent rain cannot fall.

As regards the sunsets spoken of, there are three similar instances on record. The first of these was in the year 526, when a dry fog covered the Roman Empire with a red haze. Nothing further is known concerning it. The other instances were in the years 1783 and 1831. The former of these has been traced to the great eruption of Skaptur Jökull in that year. It lasted for several months as a pale blue haze, and occasioned so much obscurity that the sun was only visible when twelve degrees above the horizon, and then it had a blood-red appearance. Violent thunderstorms were associated with it, thus assimilating it with that of 1883. Alike in 1783 and 1831 there was a pearly, phosphorescent gleam in the atmosphere, by which small print could be read at midnight. We know nothing regarding the meteorological conditions of 1831.

The red sunsets of 1883 were remarkable for their long persistence. They were observed in the autumn of 1884 with almost

their original brilliancy, and they were still visible in 1885, being seen at intervals, as if the dust was then distributed in patches, and driven about by the winds. In fact, similar sunsets were occasionally visible for several years afterwards. These may well have been due to the same cause, when we consider with what extreme slowness very fine dust makes its way through the air, and how much it may be affected by the winds.

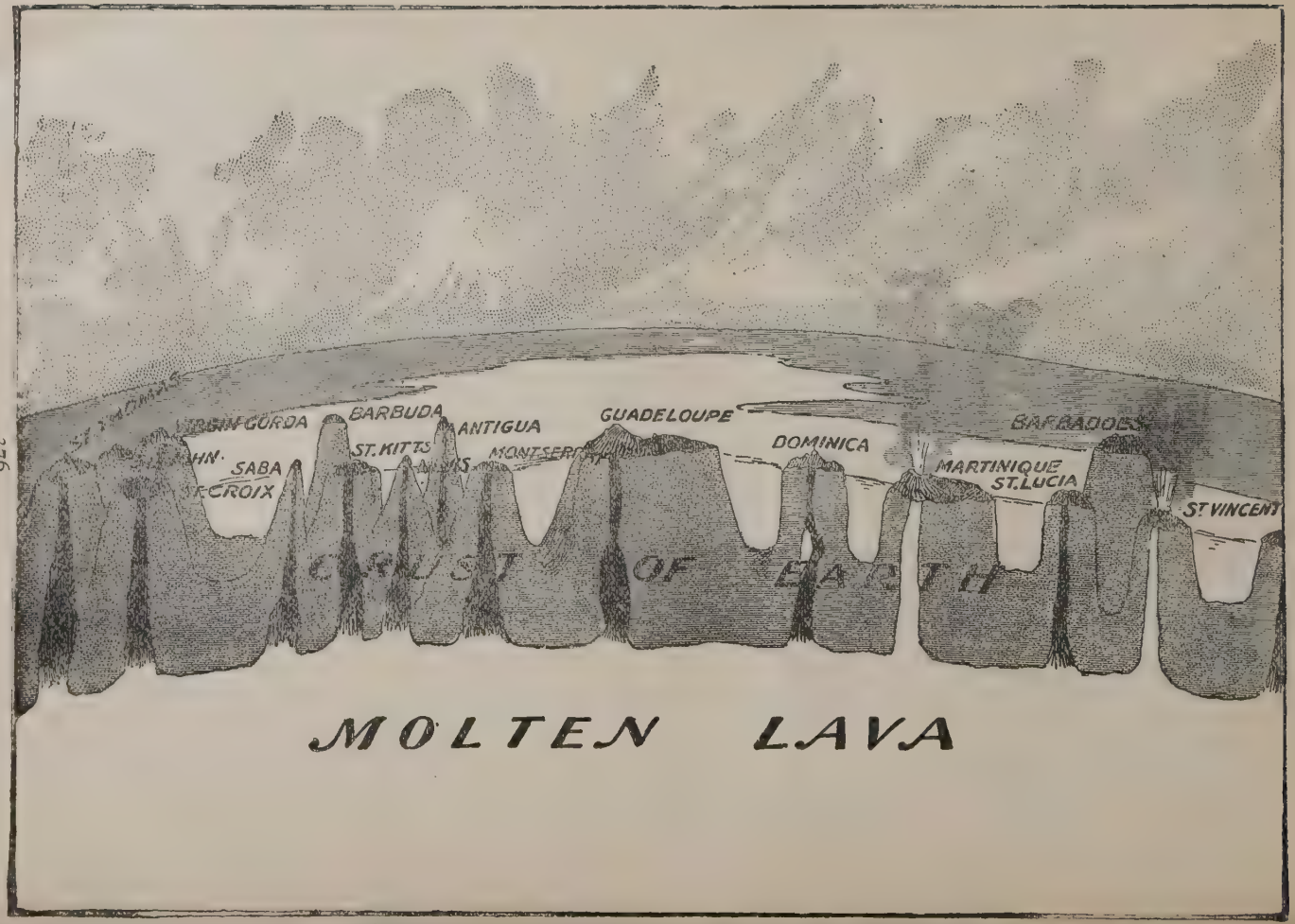
THE RED SUNSETS DESCRIBED

One writer describes the appearance of these sunsets in the following terms: "Immediately after sunset a patch of white light appeared ten or fifteen degrees above the horizon, and shone for ten minutes with a pearly lustre. Beneath it a layer of bright red rested on the horizon, melting upward into orange, and this passed into yellow light, which spread around the lucid spot. Next the white light grew of a rosy tint, and soon became an intense rose hue. A vivid golden oriole yellow strip divided it from the red fringe below and the rose red above." This description, although exaggerated, represents the general conditions of the phenomenon.

On October 20th, 1884, the author observed the sunset effect as follows: 'Immediately after the sun had set, a broad cone of silvery lustre rested upon a horizon of smoky pink. After fifteen minutes the white became rose color above and yellowish below, deepening to lemon color, and finally into reddish tint, while the rose faded out. The whole cone gradually sank and died away in the brownish red flush on the horizon, more than an hour after sunset. The time of duration varied, since, on the succeeding evening, it lasted only a half-hour. These sunset effects, if we can justly attribute them all to the Krakatoa eruption, were extraordinary

not alone for their intensity and beauty but for their extended duration, the influence of this remarkable volcanic outbreak being visible for several years after the event.

Though no doubt is entertained concerning the cause of the red sunset effects of 1783 and 1883, that of 1831 is not so readily explained, there having been no known volcanic explosion of great intensity in that year. But in view of the fact that volcanoes exist in unvisited parts of the earth, some of which may have been at work unknown to scientific man, this difficulty is not insuperable. Possibly Mounts Erebus or Terror, the burning mountains of the Antarctic zone, may, unseen by man, have prepared for civilized lands this grand spectacular effect of Nature's doings.



SECTIONAL VIEW OF EARTH'S CRUST IN THE WEST INDIES

CHAPTER XXX.

St. Vincent Island and Mont Soufriere in 1812.

AMONG all the islands of the Caribbees St. Vincent is unique in natural wonders and beauties. Situated about ninety-five miles west of Barbados, it has a length of eighteen and a width of eleven miles, the whole mass being largely composed of a single peak which rises from the ocean's bed. From north to south volcanic hills traverse its length, their ridges intersected by fertile and beautiful valleys.

A ridge of mountains crosses the island, dividing it into eastern and western parts. Kingstown, the capital, a town of 8,000 inhabitants, is on the southward side and extends along the shores of a beautiful bay, with mountains gradually rising behind it in the form of a vast amphitheatre. Three streets, broad and lined with good houses, run parallel to the water-front. There are many other intersecting highways, some of which lead back to the foot-hills, from which good roads ascend the mountains.

The majority of the houses have red tile roofing and a goodly number of them are of stone, one story high, with thick walls after the Spanish style—the same types of houses that were in St. Pierre and which are not unlike the old Roman houses which in all stages of ruin and semi-preservation are found in Pompeii to this day.

Behind the general group of the houses of the town loom the Governor's residence and the buildings of the botanical gardens which overlook the town.

Kingstown is the trading centre and the town of importance in the island. It contains the churches and chapels of five Protestant denominations and a number of excellent schools. Away from Kingstown, and the smaller settlement of Georgetown, the population is almost wholly rural, occupying scattered villages which consist of negro huts clustering around a few substantial buildings or of cabins grouped about old plantation buildings somewhat after the ante-bellum fashion in our own Southern States.

One of the tragedies of the West Indies was the sinking of old Port Royal, the resort of buccaneers, in 1692. The harbor of Kingstown is commonly supposed to cover the site of the old settlement. There is a tradition that a buoy for many years was attached to the spire of a sunken church in order to warn mariners. Three thousand persons perished in the disaster.

DESCENDANTS OF ORIGINAL INDIAN POPULATION

The northern portion of the island, that desolated by the recent volcanic eruption, was inhabited by people living in the manner just described, the great majority of them being negroes. The total population of the island is about 45,000, of whom 30,000 are Africans and about 3,000 Europeans, the remainder being nearly all Asiatics. There are, or rather were, a number of Caribs, the descendants of the original warlike Indian population of these islands. Many of these live in St. Vincent, though there are others in Dominico. As their residence was in the northern section of the island, the volcano seems to have completed the work for the Caribs of this island which the Spaniard long ago began. These Caribs were really half-breds, having amalgamated with the negroes. Many of the blacks own land of their own, raising arrow root, which, since the decay of the sugar industry, is the chief export.

In an island only eighteen miles long by eleven broad there is not room for any distinctly marked mountain range. The whole of St. Vincent, in fact, is a fantastic tumble of hills, culminating in the volcanic ridge which runs lengthwise of the oval-shaped island. The culminating peak of the great volcanic mass, for St. Vincent is nothing more, is Mont Garou, of which La Soufriere is a sort of lofty excrescence in the northwest, 4,048 feet high, and flanking the main peak at some distance away.

It may be said that all the volcanic mountains in this part of the West Indies have what the people call a "soufriere"—a "sulphur pit," or "sulphur crater"—the name coming, as in the case of past disturbances of Mont Pelee, from the strong stench of sulphuretted hydrogen which issues from them when the volcano becomes agitated.

In 1812 it was La Soufriere adjacent to Mont Garou which broke loose on the island of St. Vincent, and it was the same Soufriere which again devastated the island in 1902 and bombarded Kingstown with rocks, lava and ashes.

The old crater of Mont Garou has long been extinct, and, like the old crater of Mont Pelee, near St. Pierre, it had far down in its depths, surrounded by sheer cliffs from 500 to 800 feet high, a lake. Glimpses of the lake of Mont Garou are difficult to get, owing to the thick verdure growing about the dangerous edges of the precipices, but those who have seen it describe it as a beautiful sheet of deep blue water.

THE APPEARANCF OF THE SOUFRIERE

Previous to the eruption of 1812 the appearance of the Soufriere was most interesting. The crater was half a mile in diameter and five hundred feet in depth. In its centre was a

conical hill, fringed with shrubs and vines; at whose base were two small lakes, one sulphurous, the other pure and tasteless. This lovely and beautiful spot was rendered more interesting by the singularly melodious notes of a bird, an inhabitant of these upper solitudes, and altogether unknown to the other parts of the island —hence called, or supposed to be, "invisible," as it had never been seen. (It is of interest to state that Frederick A. Ober, in a visit to the island some twenty years ago, succeeded in obtaining specimens of this previously unknown bird.) From the fissures of the cone a thin white smoke exuded, occasionally tinged with a light blue flame. Evergreens, flowers and aromatic shrubs clothed the steep sides of the crater, which made, as the first indication of the eruption on April 27, 1812, a tremulous noise in the air. A severe concussion of the earth followed, and then a column of thick black smoke burst from the crater.

THE ERUPTION OF 1812

The eruption which followed these premonitory symptoms was one of the most terrific which had occurred in the West Indies up to that time. It was the culminating event which seemed to relieve a pressure within the earth's crust which extended from the Mississippi Valley to Caracas, Venezuela, producing terrible effects in the latter place. Here, thirty-five days before the volcanic explosion, the ground was rent and shaken by a frightful earthquake which hurled the city in ruins to the ground and killed ten thousand of its inhabitants in a moment of time.

La Soufriere made the first historic display of its hidden powers in 1718, when lava poured from its crater. A far more violent demonstration of its destructive forces was that above mentioned. On his occasion the eruption lasted for three days, ruining a number of

the estates in the vicinity and destroying many lives. Myriads of tons of ashes, cinders, pumice and scoriæ, hurled from the crater, fell in every section of the island. Volumes of sand darkened the air, and woods, ridges and cane fields were covered with light gray ashes, which speedily destroyed all vegetation. The sun for three days seemed to be in a total eclipse, the sea was discolored and the ground bore a wintry appearance from the white crust of fallen ashes.

Carib natives who lived at Morne Rond fled from their houses to Kingstown. As the third day drew to a close flames sprang pyramidically from the crater, accompanied by loud thunder and electric flashes, which rent the column of smoke hanging over the volcano. Eruptive matter pouring from the northwest side plunged over the cliff, carrying down rocks and woods in its course. The island was shaken by an earthquake and bombarded with showers of cinders and stones, which set houses on fire and killed many of the natives.

THE TERRIBLE EARTHQUAKE AT CARACAS

For nearly two years before this explosion earthquakes had been common, and sea and land had been agitated from the valley of the Mississippi to the coasts of Venezuela and the mountains of New Grenada, and from the Azores to the West Indies. On March 26, 1812, these culminated in the terrible tragedy, spoken of above, of which Humboldt gives us a vivid account.

On that day the people of the Venezuelan city of Caracas were assembled in the churches, beneath a still and blazing sky, when the earth suddenly heaved and shook, like a great monster waking from slumber, and in a single minute 10,000 people were buried beneath the walls of churches and houses, which tumbled in hideous ruin upon their heads. The same earthquake made itself

felt along the whole line of the Northern Cordilleras, working terrible destruction, and shook the earth as far as Santa Fé de Bogota and Honda, 180 leagues from Caracas. This was a preliminary symptom of the internal disorder of the earth.

While the wretched inhabitants of Caracas who had escaped the earthquake were dying of fever and starvation, and seeking among villages and farms places of safety from the renewed earthquake shocks, the almost forgotten volcano of St. Vincent was muttering in suppressed wrath. For twelve months it had given warning, by frequent shocks of the earth, that it was making ready to play its part in the great subterranean battle. On the 27th of April its deep-hidden powers broke their bonds, and the conflict between rock and fire began.

THE MOUNTAIN STONES A HERD-BOY

The first intimation of the outbreak was rather amusing than alarming. A negro boy was herding cattle on the mountain side. A stone fell near him. Another followed. He fancied that some other boys were pelting him from the cliff above, and began throwing stones upward at his fancied concealed tormentors. But the stones fell thicker, among them some too large to be thrown by any human hand. Only then did the little fellow awake to the fact that it was not a boy like himself, but the mighty mountain, that was flinging these stones at him. He looked up and saw that the black column which was rising from the crater's mouth was no longer harmless vapor, but dust, ashes and stones. Leaving the cattle to their fate, he fled for his life, while the mighty cannon of the Titans roared behind him as he ran. For three days and nights this continued; then, on the 30th, a stream of lava poured over the crater's rim and rushed downward, reaching the sea in four hours, and the great eruption was at an end.

On the same day, says Humboldt, at a distance of more than 200 leagues, "the inhabitants not only of Caracas, but of Calabozo, situated in the midst of the Lianos, over a space of 4,000 square leagues, were terrified by a subterranean noise which resembled frequent discharges of the heaviest cannon. It was accompanied by no shock, and, what is very remarkable, was as loud on the coast as at eighty leagues' distance inland, and at Caracas, as well as at Calabozo, preparations were made to put the place in defence against an enemy who seemed to be advancing with heavy artillery."

It was no enemy that man could deal with. Fortunately, it confined its assault to deep noises, and desisted from earthquake shocks. Similar noises were heard in Martinique and Guadeloupe, and here also without shocks. The internal thunder was the signal of what was taking place on St. Vincent. With this last warning sound the trouble, which had lasted so long, was at an end. The earthquakes which for two years had shaken a sheet of the earth's surface larger than half Europe, were stilled by the eruption of St. Vincent's volcanic peak.

BARBADOS COVERED WITH ASHES

Northeast of the original crater of the Soufriere a new one was formed which was a half mile in diameter and five hundred feet deep. The old crater was in time transformed into a beautiful blue lake, as above stated, walled in by ragged cliffs to a height of eight hundred feet.

It was looked upon as a remarkable circumstance that although the air was perfectly calm during the eruption, Barbados, which is ninety-five miles to the windward, was covered inches deep with ashes. The inhabitants there and on other neighboring islands were

terrified by the darkness, which continued for four hours and a half. Troops were called under arms, the supposition from the continued noise being that hostile fleets were in an engagement.

The movement of the ashes to windward, as just stated, was viewed as a remarkable phenomenon, and is cited by Elise Reclus, in "The Ocean," to show the force of different aerial currents; "On the first day of May, 1812 when the northeast trade-wind was in all its force, enormous quantities of ashes obscured the atmosphere above the Island of Barbados, and covered the ground with a thick layer. One would have supposed that they came from the volcanoes of the Azores, which were to the northeast; nevertheless they were cast up by the crater in St. Vincent, one hundred miles to the west. It is therefore certain that the debris had been hurled, by the force of the eruption, above the moving sheet of the trade-winds into an aerial river proceeding in a contrary direction." For this it must have been hurled miles high into the air, till caught by the current of the anti-trade winds.

KINGSLEY'S VISIT TO SAINT VINCENT

From Charles Kingsley's "At Last" we extract, from the account of the visit of the author to St. Vincent, some interesting matter concerning the 1812 eruption and its effect on the mountain; also its influence upon distant Barbados, as just stated.

"The strangest fact about this eruption was, that the mountain did not make use of its old crater. The original vent must have become so jammed and consolidated, in the few years between 1785 and 1812, that it could not be reopened, even by a steam force the vastness of which may be guessed at from the vastness of the area which it had shaken for two years. So, when the eruption was over, it was found that the old crater-lake, incredible as it may

seem, remained undisturbed, so far as has been ascertained; but close to it, and separated only by a knife-edge of rock some 700 feet in height, and so narrow that, as I was assured by one who had seen it, it is dangerous to crawl along it, a second crater, nearly as large as the first, had been blasted out, the bottom of which, in like manner, was afterward filled with water.

"I regretted much that I could not visit it. Three points I longed to ascertain carefully—the relative heights of the water in the two craters; the height and nature of the spot where the lava stream issued; and, lastly, if possible, the actual causes of the locally famous Rabacca, or 'Dry River,' one of the largest streams in the island, which was swallowed up during the eruption, at a short distance from its source, leaving its bed an arid gully to this day. But it could not be, and I owe what little I know of the summit of the soufriere principally to a most intelligent and gentlemanlike young Wesleyan minister, whose name has escaped me. He described vividly, as we stood together on the deck, looking up at the volcano, the awful beauty of the twin lakes, and of the clouds which, for months together, whirl in and out of the cups in fantastic shapes before the eddies of the trade wind.

BLACK SUNDAY AT BARBADOS

"The day after the explosion, 'Black Sunday,' gave a proof of, though no measure of, the enormous force which had been exerted. Eighty miles to windward lies Barbados. All Saturday a heavy cannonading had been heard to the eastward. The English and French fleets were surely engaged. The soldiers were called out; the batteries manned; but the cannonade died away, and all went to bed in wonder. On the 1st of May the clocks struck six, but the sun did not, as usual in the tropics, answer to the call.

The darkness was still intense, and grew more intense as the morning wore on. A slow and silent rain of impalpable dust was falling over the whole island. The negroes rushed shrieking into the streets. Surely the last day was come. The white folk caught (and little blame to them) the panic, and some began to pray who had not prayed for years. The pious and the educated (and there were plenty of both in Barbados) were not proof against the infection. Old letters describe the scene in the churches that morning as hideous—prayers, sobs, and cries, in Stygian darkness, from trembling crowds. And still the darkness continued and the dust fell.

INCIDENTS AT BARBADOS

"I have a letter written by one long since dead, who had at least powers of description of no common order, telling how, when he tried to go out of his house upon the east coast, he could not find the trees on his own lawn save by feeling for their stems. He stood amazed not only in utter darkness, but in utter silence; for the trade-wind had fallen dead, the everlasting roar of the surf was gone, and the only noise was the crashing of branches, snapped by the weight of the clammy dust. He went in again, and waited. About one o'clock the veil began to lift; a lurid sunlight stared in from the horizon, but all was black overhead. Gradually the dust drifted away; the island saw the sun once more, and saw itself inches deep in black, and in this case fertilizing, dust. The trade-wind blew suddenly once more out of the clear east, and the surf roared again along the shore.

"Meanwhile a heavy earthquake-wave had struck part at least of the shores of Barbados. The gentleman on the east coast, going out, found traces of the sea, and boats and logs washed up some

ten to twenty feet above high-tide mark; a convulsion which seemed to have gone unmarked during the general dismay.

"One man at least, an old friend of John Hunter, Sir Joseph Banks and others their compeers, was above the dismay, and the superstitious panic which accompanied it. Finding it still dark when he rose to dress, he opened (so the story used to run) his window; found it stick, and felt upon the sill a coat of soft powder. 'The volcano in St. Vincent has broken out at last,' said the wise man, 'and this is the dust of it.' So he quieted his household and his negroes, lighted his candles, and went to his scientific books, in that delight, mingled with an awe not the less deep, because it is rational and self-possessed, with which he, like the other men of science, looked at the wonders of this wondrous world."

On May 7, 1902, simultaneously with the terrible explosion of Mount Pelee, Martinique, St. Vincent was visited with an eruption more violent than that of 1812, Soufriere bursting out in flames and smoke and spreading ruin and death over a great part of the island. It was estimated that 1600 people were killed, including nearly the whole of the Carib Indians, the remnant of a famous West Indian tribe. The outbreak was repeated at intervals for several weeks, leaving the country buried deep in volcanic ashes and converting a fertile island into a desolate and forbidding waste.

CHAPTER XXXI.

Mount Pelee and its Harvest of Death.

ST. PIERRE, the principal city of the French island of Martinique, in the West Indies, lies for the length of about a mile along the island coast, with high cliffs hemming it in, its houses climbing the slope, tier upon tier. At one place where a river breaks through the cliffs, the city creeps further up towards the mountains. As seen from the bay, its appearance is picturesque and charming, with the soft tints of its tiles, the grey of its walls, the clumps of verdure in its midst, and the wall of green in the rear. Seen from its streets this beauty disappears, and the chief attraction of the town is gone.

Back from the three miles of hills which sweep in an arc round the town, is the noble *Montagne Pelée* lying several miles to the north of the city, a mass of dark rock some four thousand feet high, with jagged outline, and cleft with gorges and ravines, down which flow numerous streams, gushing from the crater lake of the great volcano.

Though known to be a volcano, it was looked upon as practically extinct, though as late as August, 1856, it had been in eruption. No lava at that time came from its crater, but it hurled out great quantities of ashes and mud, with strong sulphurous odor. Then it went to rest again, and slept till 1902.

The people had long ceased to fear it. No one expected that grand old Mount Pelee, the slumbering (so it was thought)

tranquil old hill, would ever spurt forth fire and death. This was entirely unlooked for. Mont Pelee was regarded by the natives as a sort of protector; they had an almost superstitious affection for it. From the outskirts of the city it rose gradually, its sides grown thick with rich grass, and dotted here and there with spreading shrubbery and drooping trees. There was no pleasanter outing for an afternoon than a journey up the green, velvet-like sides of the towering mountain and a view of the quaint, picturesque city slumbering at its base.

A PEACEFUL SCENE

There were no rocky cliffs, no crags, no protruding boulders. The mountain was peace itself, It seemed to promise perpetual protection. The poetic natives relied upon it to keep back storms from the land and frighten, with its stern brow, the tempests from the sea. They pointed to it with profoundest pride as one of the most beautiful mountains in the world.

Children played in its bowers and arbors; families picnicked there day after day during the balmy weather; hundreds of tourists ascended to the summit and looked with pleasure at the beautiful crystal lake which sparkled and glinted in the sunshine. Mont Pelee was the place of enjoyment of the people of St. Pierre. I can hear the placid natives say: "Old Father Pelee is our protector—not our destroyer."

Not until two weeks before the eruption did the slumbering mountain show signs of waking to death and disaster. On the 23d of April it first displayed symptoms of internal disquiet, A great column of smoke began to rise from it, and was accompanied from time to time by showers of ashes and cinders.

Despite these signals, there was nothing until Monday, May 5th, to indicate actual danger. On that day a stream of smoking

mud and lava burst through the top of the crater and plunged into the valley of the River Blanche, overwhelming the Guerin sugar works and killing twenty-three workmen and the son of the proprietor. Mr. Guerin's was one of the largest sugar works on the island; its destruction entailed a heavy loss. The mud which overwhelmed it followed the beds of streams towards the north of the island.

The alarm in the city was great, but it was somewhat allayed by the report of an expert commission appointed by the Governor, which decided that the eruption was normal and that the city was in no peril. To further allay the excitement, the Governor, with several scientists, took up his residence in St. Pierre. He could not restrain the people by force, but the moral effect of his presence and the decision of the scientists had a similar disastrous result.

A GRAPHIC DESCRIPTION BY A SUFFERER.

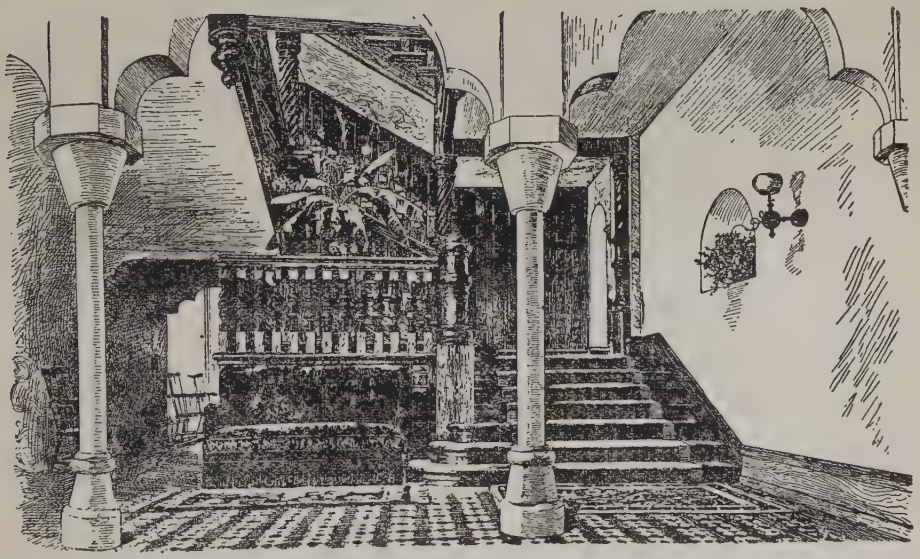
The existing state of affairs during these few waiting days is so graphically given in a letter from Mrs. Thomas T. Prentis, wife of the United States Consul at St. Pierre, to her sister in Melrose, a suburban city of Boston, that we quote it here:

"*My Dear Sister:* This morning the whole population of the city is on the alert and every eye is directed toward Mont Pelee, an extinct volcano. Everybody is afraid that the volcano has taken into its heart to burst forth and destroy the whole island.

"Fifty years ago Mont Pelee burst forth with terrific force and destroyed everything within a radius of several miles. For several days the mountain has been bursting forth in flame and immense quantities of lava are flowing down its sides.

"All the inhabitants are going up to see it. There is not a horse to be had on the island, those belonging to the natives being kept in readiness to leave at a moment's notice.

"Last Wednesday, which was April 23d, I was in my room with little Christine, and we heard three distinct shocks. They were so great that we supposed at first that there was some one at the door, and Christine went and found no one there. The first report was very loud, and the second and third were so great that dishes were thrown from the shelves and the house was rocked.



INTERIOR OF A HOME IN ST. PIERRE.

"We can see Mont Pelee from the rear windows of our house, and although it is fully four miles away, we can hear the roar of the fire and lava issuing from it.

"The city is covered with ashes and clouds of smoke have been over our heads for the last five days. The smell of sulphur is so strong that horses on the streets stop and snort, and some of them are obliged to give up, drop in their harness and die from suffocation. Many of the people are obliged to wear wet handkerchiefs over their faces to protect them from the fumes of sulphur.

"My husband assures me that there is no immediate danger, and when there is the least particle of danger we will leave the place. There is an American schooner, the *R. J. Morse*, in the harbor, and she will remain here for at least two weeks. If the volcano becomes very bad we shall embark at once and go out to sea. The papers in this city are asking if we are going to experience another earthquake similar to that which struck here some fifty years ago."

THE FATEFUL EIGHTH OF MAY

The writer of this letter and her husband, Consul Prentis, trusted Mont Pelee too long. They perished, with all the inhabitants of the city, in a deadly flood of fire and ashes that descended on the devoted place on the fateful morning of Thursday, May 8th. Only for the few who were rescued from the ships in the harbor there would be scarcely a living soul to tell that dread story of ruin and death. The most graphic accounts are those given by rescued officers of the *Roraima*, one of the fleet of the Quebec Steamship Co., trading with the West Indies. This vessel had left the Island of Dominica for Martinique at midnight of Wednesday, and reached St. Pierre about 7 o'clock Thursday morning. The greatest difficulty was experienced in getting into port, the air being thick with falling ashes and the darkness intense. The ship had to grope its way to the anchorage. Appalling sounds were issuing from the mountain behind the town, which was shrouded in darkness. The ashes were falling thickly on the steamer's deck, where the passengers and others were gazing at the town, some being engaged in photographing the scene.

The best way in which we can describe a scene of which few lived to tell the story, is to give the narratives of a number of the survivors. From their several stories a coherent idea of the terrible

A VIEW OF ST. PIERRE, WITH MOUNT PELEE IN THE BACKGROUND.

Copyrighted by Judge Publishing Co., 1902.

THE CLOCK THAT TOLD THE STORY OF MARTINIQUE.

This picture shows the ruins of the Hospital of St. Pierre and the clock with the hands pointing to 7.50, which indicated the time at which **the city was overwhelmed.**

THE ILL-FATED ST. PIERRE, OVERWHELMED WITH DESTRUCTION.

On evening of May 8, 1902, Mount Pelee burst forth with fire and smoke. In a few moments

Copyright, J. Murray Jordan.

THE HARBOR OF ST. PIERRE, MARTINIQUE.

scene can be formed. From the various accounts given of the terrible explosion by officers of the *Roraima*, we select as a first example the following description by Assistant Purser Thompson :

A TALE OF SUDDEN RUIN

"I saw St. Pierre destroyed. It was blotted out by one great flash of fire. Nearly 40,000 persons were all killed at once. Out of eighteen vessels lying in the roads only one, the British steamship *Roddam*, escaped, and she, I hear, lost more than half on board. It was a dying crew that took her out.

"Our boat, the *Roraima*, of the Quebec Line, arrived at St. Pierre early Thursday morning. For hours before we entered the roadstead we could see flames and smoke rising from Mont Pelee. No one on board had any idea of danger. Captain G. T. Muggah was on the bridge, and all hands got on deck to see the show.

"The spectacle was magnificent. As we approached St. Pierre we could distinguish the rolling and leaping of the red flames that belched from the mountain in huge volumes and gushed high into the sky. Enormous clouds of black smoke hung over the volcano.

"When we anchored at St. Pierre I noticed the cable steamship *Grappler*, the *Roddam*, three or four American schooners and a number of Italian and Norwegian barks. The flames were then spurting straight up in the air, now and then waving to one side or the other for a moment and again leaping suddenly higher up.

"There was a constant muffled roar. It was like the biggest oil refinery in the world burning up on the mountain top. There was a tremendous explosion about 7.45 o'clock, soon after we got in. The mountain was blown to pieces. There was no warning. The side of the volcano was ripped out, and there was hurled

straight toward us a solid wall of flame. It sounded like thousands of cannon.

"The wave of fire was on us and over us like a lightning flash. It was like a hurricane of fire. I saw it strike the cable steamship *Grappler* broadside on and capsize her. From end to end she burst into flames and then sank. The fire rolled in mass straight down upon St. Pierre and the shipping. The town vanished before our eyes and the air grew stifling hot, and we were in the thick of it.

"Wherever the mass of fire struck the sea the water boiled and sent up vast clouds of steam. The sea was torn into huge whirlpools that careened toward the open sea.

"One of these horrible hot whirlpools swung under the *Roraima* and pulled her down on her beam ends with the suction. She careened way over to port, and then the fire hurricane from the volcano smashed her, and over she went on the opposite side. The fire wave swept off the masts and smokestack as if they were cut with a knife.

HEAT CAUSED EXPLOSIONS

"Captain Muggah was the only one on deck not killed outright. He was caught by the fire wave and terribly burned. He yelled to get up the anchor, but, before two fathoms were heaved in the *Roraima* was almost upset by the boiling whirlpool, and the fire wave had thrown her down on her beam ends to starboard. Captain Muggah was overcome by the flames. He fell unconscious from the bridge and toppled overboard.

"The blast of fire from the volcano lasted only a few minutes. It shriveled and set fire to everything it touched. Thousands of casks of rum were stored in St. Pierre, and these were exploded by the terrific heat. The burning rum ran in streams down every street

and out to the sea. This blazing rum set fire to the *Roraima* several times. Before the volcano burst the landings of St. Pierre were crowded with people. After the explosion not one living being was seen on land. Only twenty-five of those on the *Roraima* out of sixty-eight were left after the first flash.

"The French cruiser *Suchet* came in and took us off at 2 P. M. She remained nearby, helping all she could, until 5 o'clock, then went to Fort de France with all the people she had rescued. At that time it looked as if the entire north end of the island was on fire."

C. C. Evans, of Montreal, and John G. Morris, of New York, who were among those rescued, say the vessel arrived at 6 o'clock. As eight bells were struck a frightful explosion was heard up the mountain. A cloud of fire, toppling and roaring, swept with lightning speed down the mountain side and over the town and bay. The *Roraima* was nearly sunk, and caught fire at once.

"I can never forget the horrid, fiery, choking whirlwind which enveloped me," said Mr. Evans. "Mr. Morris and I rushed below. We are not very badly burned, not so bad as most of them. When the fire came we were going to our posts (we are engineers) to weigh anchor and get out. When we came up we found the ship afire aft, and fought it forward until 3 o'clock, when the *Suchet* came to our rescue. We were then building a raft."

"Ben" Benson, the carpenter of the *Roraima,* said: "I was on deck, amidships, when I heard an explosion. The captain ordered me to up anchor. I got to the windlass, but when the fire came I went into the forecastle and got my 'duds.' When I came out I talked with Captain Muggah, Mr. Scott, the first officer and others. They had been on the bridge. The captain was horribly burned. He had inhaled flames and wanted to jump into the sea.

I tried to make him take a life-preserver. The captain, who was undressed, jumped overboard and hung on to a line for a while. Then he disappeared."

THE COOPER'S STORY.

James Taylor, a cooper employed on the *Roraima*, gives the following account of his experience of the disaster:

"Hearing a tremendous report and seeing the ashes falling thicker, I dived into a room, dragging with me Samuel Thomas, a gangway man and fellow countryman, shutting the door tightly. Shortly after I heard a voice, which I recognized as that of the chief mate, Mr. Scott. Opening the door with great caution, I drew him in. The nose of Thomas was burned by the intense heat.

"We three and Thompson, the assistant purser, out of sixty-eight souls on board, were the only persons who escaped practically uninjured. The heat being unbearable, I emerged in a few moments, and the scene that presented itself to my eyes baffles description. All around on the deck were the dead and dying covered with boiling mud. There they lay, men, women and little children, and the appeals of the latter for water were heart-rending. When water was given them they could not swallow it, owing to their throats being filled with ashes or burnt with the heated air.

"The ship was burning aft, and I jumped overboard, the sea being intensely hot. I was at once swept seaward by a tidal wave, but, the sea receding a considerable distance, the return wave washed me against an upturned sloop to which I clung. I was joined by a man so dreadfully burned and disfigured as to be unrecognizable. Afterwards I found he was the captain of the *Roraima*, Captain Muggah. He was in dreadful agony, begging piteously to be put on board his ship.

"Picking up some wreckage which contained bedding and a tool chest, I, with the help of five others who had joined me on the wreck, constructed a rude raft, on which we placed the captain. Then, seeing an upturned boat, I asked one of the five, a native of Martinique, to swim and fetch it. Instead of returning to us, he picked up two of his countrymen and went away in the direction of Fort de France. Seeing the *Roddam*, which arrived in port shortly after we anchored, making for the *Roraima*, I said good-bye to the captain and swam back to the *Roraima*.

"The *Roddam*, however, burst into flames and put to sea. I reached the *Roraima* at about half-past 2, and was afterwards taken off by a boat from the French warship *Suchet*. Twenty-four others with myself were taken on to Fort de France. Three of these died before reaching port. A number of others have since died."

Samuel Thomas, the gangway man, whose life was saved by the forethought of Taylor, says that the scene on the burning ship was awful. The groans and cries of the dying, for whom nothing could be done, were horrible. He describes a woman as being burned to death with a living babe in her arms. He says that it seemed as if the whole world was afire.

CONSUL AYME'S STATEMENT

The inflammable material in the forepart of the ship that would have ignited that part of the vessel was thrown overboard by him and the other two uninjured men. The *Grappler*, the telegraph company's ship, was seen opposite the *Usine Guerin*, and disappeared as if blown up by a submarine explosion. The captain's body was subsequently found by a boat from the *Suchet*.

Consul Ayme, of Guadeloupe, who, as already stated, had hastened to Fort de France on hearing of the terrible event, tells the story of the disaster in the following words:

"Thursday morning the inhabitants of the city awoke to find heavy clouds shrouding Mont Pelee crater. All day Wednesday horrid detonations had been heard. These were echoed from St. Thomas on the north to Barbados on the south. The cannonading ceased on Wednesday night, and fine ashes fell like rain on St. Pierre. The inhabitants were alarmed, but Governor Mouttet, who had arrived at St. Pierre the evening before, did everything possible to allay the panic.

"The British steamer *Roraima* reached St. Pierre on Thursday with ten passengers, among whom were Mrs. Stokes and her three children, and Mrs. H. J. Ince. They were watching the rain of ashes, when, with a frightful roar and terrific electric discharges, a cyclone of fire, mud and steam swept down from the crater over the town and bay, sweeping all before it and destroying the fleet of vessels at anchor off the shore. There the accounts of the catastrophe so far obtainable cease. Thirty thousand corpses are strewn about, buried in the ruins of St. Pierre, or else floating, gnawed by sharks, in the surrounding seas. Twenty-eight charred, half-dead human beings were brought here. Sixteen of them are already dead, and only four of the whole number are expected to recover."

A WOMAN'S EXPERIENCE ON THE "RORAIMA"

Margaret Stokes, the 9 year old daughter of the late Clement Stokes, of New York, who, with her mother, a brother aged 4 and a sister aged 3 years, was on the ill-fated steamer *Roraima*, was saved from that vessel, but is not expected to live. Her nurse, Clara King, tells the following story of her experience:

She says she was in her stateroom, when the steward of the *Roraima* called out to her:

"Look at Mont Pelee."

She went on deck and saw a vast mass of black cloud coming down from the volcano. The steward ordered her to return to the saloon, saying, "It is coming."

Miss King then rushed to the saloon. She says she experienced a feeling of suffocation, which was followed by intense heat. The afterpart of the *Roraima* broke out in flames. Ben Benson, the carpenter of the *Roraima*, severely burned, assisted Miss King and Margaret Stokes to escape. With the help of Mr. Scott, the first mate of the *Roraima*, he constructed a raft, with life preservers. Upon this Miss King and Margaret were placed.

While this was being done Margaret's little brother died. Mate Scott brought the child water at great personal danger, but it was unavailing. Shortly after the death of the little boy Mrs. Stokes succumbed. Margaret and Miss King eventually got away on the raft, and were picked up by the steamer *Korona*. Mate Scott also escaped. Miss King did not sustain serious injuries. She covered the face of Margaret with her dress, but still the child was probably fatally burned.

The only woman known at that time to have survived the disaster at St. Pierre was a negress named Fillotte. She was found in a cellar Saturday afternoon, where she had been for three days. She was still alive, but fearfully burned from head to toes. She died afterward in the hospital.

CAPTAIN FREEMAN'S THRILLING ACCOUNT

Of the vessels in the harbor of St. Pierre on the fateful morning, only one, the British steamer *Roddam*, escaped, and that with a crew of whom few reached the open sea alive. Those who did escape were terribly injured. Captain Freeman, of this vessel, tells what he experienced in the following thrilling language:

"St. Lucia, British West Indies, May 11.—The steamer *Roddam*, of which I am captain, left St. Lucia at midnight of May 7, and was off St. Pierre, Martinique, at 6 o'clock on the morning of the 8th. I noticed that the volcano, Mont Pelee, was smoking, and crept slowly in toward the bay, finding there among others the steamer *Roraima*, the telegraph repairing steamer *Grappler* and four sailing vessels. I went to anchorage between 7 and 8 and had hardly moored when the side of the volcano opened out with a terrible explosion. A wall of fire swept over the town and the bay. The *Roddam* was struck broadside by the burning mass. The shock to the ship was terrible, nearly capsizing her.

AWFUL RESULTS

'Hearing the awful report of the explosion and seeing the great wall of flames approaching the steamer, those on deck sought shelter wherever it was possible, jumping into the cabin, the forecastle and even into the hold. I was in the chart room, but the burning embers were borne by so swift a movement of the air that they were swept in through the door and port holes, suffocating and scorching me badly. I was terribly burned by these embers about the face and hands, but managed to reach the deck. Then, as soon as it was possible, I mustered the few survivors who seemed able to move, ordered them to slip the anchor, leaped for the bridge and ran the engine for full speed astern. The second and the third engineer and a fireman were on watch below and so escaped injury. They did their part in the attempt to escape, but the men on deck could not work the steering gear because it was jammed by the debris from the volcano. We accordingly went ahead and astern until the gear was free, but in this running backward and forward 't was two hours after the first shock before we were clear of the bay.

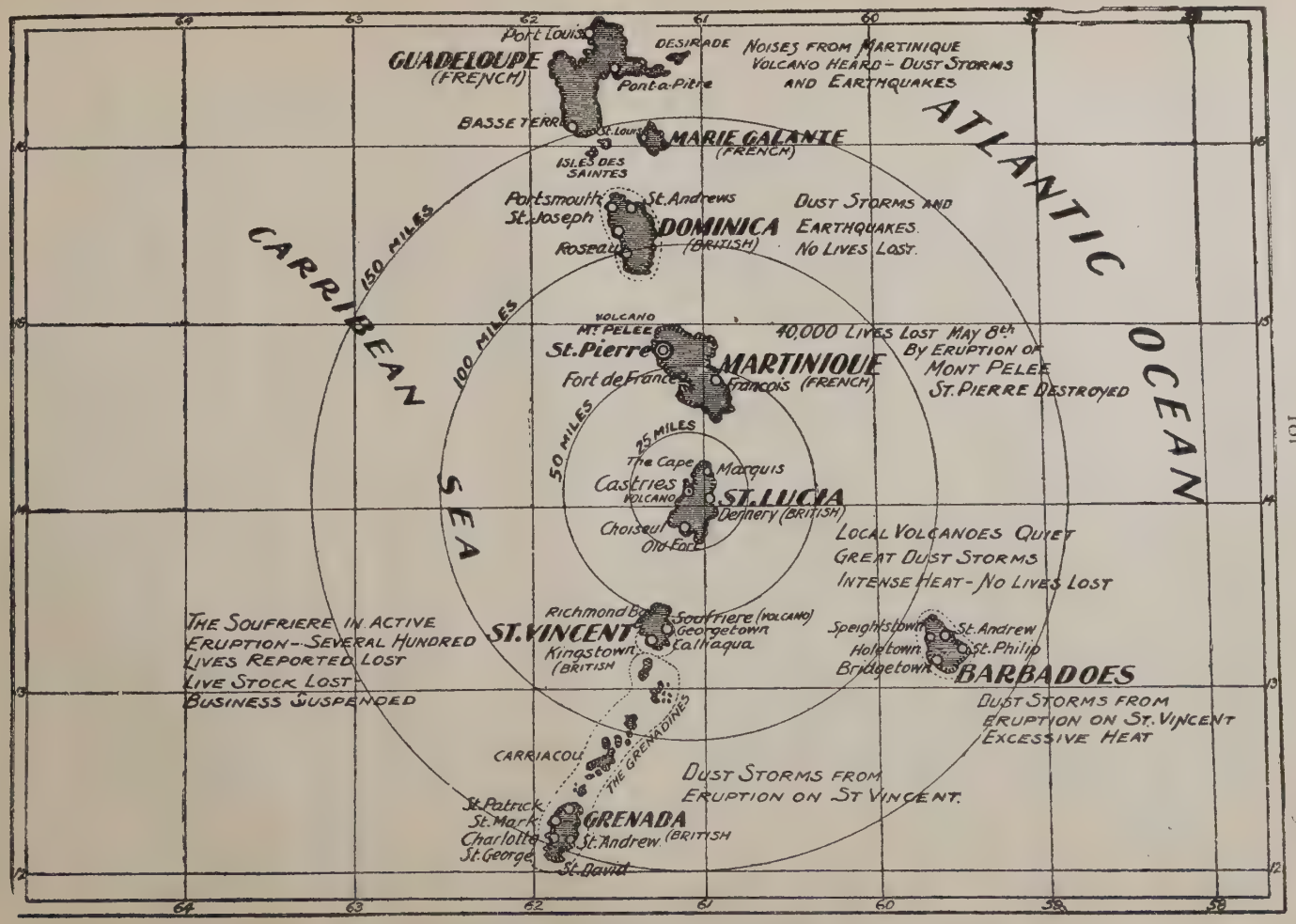


CHART OF THE WINDWARD ISLANDS

Showing the Islands affected by the great volcanic disturbances of May 8, 1902, and the relative violence noticed in each

"One of the most terrifying conditions was that, the atmosphere being charged with ashes, it was totally dark. The sun was completely obscured, and the air was only illuminated by the flames from the volcano and those of the burning town and shipping. It seems small to say that the scene was terrifying in the extreme. As we backed out we passed close to the *Roraima*, which was one mass of blaze. The steam was rushing from the engine room, and the screams of those on board were terrible to hear. The cries for help were all in vain, for I could do nothing but save my own ship. When I last saw the *Roraima* she was settling down by the stern. That was about 10 o'clock in the morning.

"When the *Roddam* was safely out of the harbor of St. Pierre, with its desolations and horrors, I made for St. Lucia. Arriving there, and when the ship was safe, I mustered the survivors as well as I was able and searched for the dead and injured. Some I found in the saloon where they had vainly sought for safety, but the cabins were full of burning embers that had blown in through the port holes. Through these the fire swept as through funnels and burned the victims where they lay or stood, leaving a circular imprint of scorched and burned flesh. I brought ten on deck who were thus burned; two of them were dead, the others survived, although in a dreadful state of torture from their burns. Their screams of agony were heartrending. Out of a total of twenty-three on board the *Roddam*, which includes the captain and the crew, ten are dead and several are in the hospital. My first and second mates, my chief engineer and my supercargo, Campbell by name, were killed. The ship was covered from stem to stern with tons of powdered lava, which retained its heat for hours after it had fallen. In many cases it was practically incandescent, and to move about the deck in this burning mass was not only difficult but absolutely perilous. I am

only now able to begin thoroughly to clear and search the ship for any damage done by this volcanic rain, and to see if there are any corpses in out-of-the-way places. For instance, this morning, I found one body in the peak of the forecastle. The body was horribly burned and the sailor had evidently crept in there in his agony to die.

"On the arrival of the *Roddam* at St. Lucia the ship presented an appalling appearance. Dead and calcined bodies lay about the deck, which was also crowded with injured, helpless and suffering people. Prompt assistance was rendered to the injured by the authorities here and my poor, tortured men were taken to the hospital. The dead were buried. I have omitted to mention that out of twenty-one black laborers that I brought from Grenada to help in stevedoring, only six survived. Most of the others threw themselves overboard to escape a dreadful fate, but they met a worse one, for it is an actual fact that the water around the ship was literally at a boiling heat. The escape of my vessel was miraculous. The woodwork of the cabins and bridge and everything inflammable on deck were constantly igniting, and it was with great difficulty that we few survivors managed to keep the flames down. My ropes, awnings, tarpaulins were completely burned up.

"I witnessed the entire destruction of St. Pierre. The flames enveloped the town in every quarter with such rapidity that it was impossible that any person could be saved. As I have said, the day was suddenly turned to night, but I could distinguish by the light of the burning town people distractedly running about on the beach. The burning buildings stood out from the surrounding darkness like black shadows. All this time the mountain was roaring and shaking, and in the intervals between these terrifying sounds I could hear the cries of despair and agony from the thousands who were perishing. These cries added to the terror of the scene, but

it is impossible to describe its horror or the dreadful sensations it produced. It was like witnessing the end of the world.

"Let me add that, after the first shock was over, the survivors of the crew rendered willing help to navigate the ship to this port. Mr. Plissoneau, our agent in Martinique, happening to be on board, was saved, and I really believe that he is the only survivor of St. Pierre. As it is, he is seriously burned on the hands and face.

"FREEMAN,

"Master British Steamship *Roddam.*"

THE "ETONA" PASSES ST. PIERRE

The British steamer *Etona*, of the Norton Line, stopped at St. Lucia to coal on May 10th. Captain Cantell there visited the *Roddam* and had an interview with Captain Freeman. On the 11th the *Etona* put to sea again, passing St. Pierre in the afternoon. We subjoin her captain's story:

"The weather was clear and we had a fine view, but the old outlines of St. Pierre were not recognizable. Everything was a mass of blue lava, and the formation of the land itself seemed to have changed. When we were about eight miles off the northern end of the island Mount Pelee began to belch a second time. Clouds of smoke and lava shot into the air and spread over all the sea, darkening the sun. Our decks in a few minutes were covered with a substance that looked like sand dyed a bluish tint, and which smelled like phosphorus. For all that the day was clear, there was little to be seen satisfactorily. Over the island there hung a blue haze. It seemed to me that the formation, the topography, of the island was altered.

"Everything seemed to be covered with a blue dust, such as had fallen aboard us every day since we had been within the affected

region. It was blue lava dust. For more than an hour we scanned the coast with our glasses, now and then discovering something that looked like a ruined hamlet or collection of buildings. There was no life visible. Suddenly we realized that we might have to fight for our lives as the *Roddam's* people had done.

"We were about four miles off the northern end of the island when suddenly there shot up in the air to a tremendous height a column of smoke. The sky darkened and the smoke seemed to swirl down upon us. In fact, it spread all around, darkening the atmosphere as far as we could see. I called Chief Engineer Farrish to the deck.

"'Do you see that over there?' I asked, pointing to the eruption, for it was the second eruption of Mont Pelee. He saw it all right. Captain Freeman's story was fresh in my mind.

"'Well, Farrish, rush your engines as they have never been rushed before,' I said to him. He went below, and soon we began to burn coal and pile up the feathers in our forefoot.

"I was on watch with Second Officer Gibbs. At once we began to furl awnings and make secure against fire. The crew were all showing an anxious spirit, and everybody on board, including the four passengers, were serious and apprehensive.

"We began to cut through the water at almost twelve knots. Ordinarily we make ten knots. We could see no more of the land contour, but everything seemed to be enveloped in a great cloud. There was no fire visible, but the lava dust rained down upon us steadily. In less than an hour there were two inches of it upon our deck.

"The air smelled like phosphorus. No one dared to look up to try to locate the sun, because one's eyes would fill with lava dust. Some of the blue lava dust is sticking to our mast yet,

although we have swabbed decks and rigging again and again to be clear of it.

"After a little more than an hour's fast running we saw daylight ahead and began to breathe easier. If I had not talked with Captain Freeman and heard from him just how the black swirl of wind and fire rolled down upon him, I would not have been so apprehensive, but would have thought that the darkness and cloud that came down upon us meant just an unusually heavy squall.'

CHIEF ENGINEER FARRISH'S STORY

"The *Etona's* run from Montevideo was a fast one—I think a record breaker. We were 22 days and 21 hours from port to port. Off Martinique I stared at the coast for about an hour, and then went below. The blue lava that covered everything faded into the haze that hung over the island so that nothing was distinctly visible. Through my glass I discovered a stream of lava, though. It stretched down the mountain side, and seemed to be flowing into the sea. It was not clearly and distinctly visible, however.

"About 3 o'clock I went below to take forty winks. I had been in my berth only a few minutes when the steward told me the captain wanted me on the bridge.

'' Do you see that, Farrish?' he asked, pointing at the land. An outburst of smoke seemed to be sweeping down upon us. It made me think of the *Roddam's* experience. Smoke and dust closed in about us, shutting out the sunlight, and precipitating a fall of lava on our decks.

" 'Go below and drive her,' said the captain, and I didn't lose any time, I can tell you. We burned coal as though it didn't cost

a cent. The safety valve was jumping every second, even though we were making twelve knots an hour. For two hours we kept up the pace, and then, running into clear daylight, let the engines slow down and we all cheered up a bit."

CAPTAIN CANTELL VISITS THE "RODDAM"

Captain Cantell went on board the *Roddam*, whose frightful condition he thus describes:

"At St. Lucia, on May 11th, I went on board the British steamship *Roddam*, which had escaped from the terrible volcanic eruption at Martinique two days before. The state of the ship was enough to show that those on board must have undergone an awful experience.

"The *Roddam* was covered with a mass of fine bluish gray dust or ashes of cement-like appearance. In some parts it lay two feet deep on the decks. This matter had fallen in a red-hot state all over the steamer, setting fire to everything it struck that was burnable, and, when it fell on the men on board, burning off limbs and large pieces of flesh. This was shown by finding portions of human flesh when the decks were cleared of the debris. The rigging, ropes, tarpaulins, sails, awnings, etc., were charred or burned, and most of the upper stanchions and spars were swept overboard or destroyed by fire. Skylights were smashed and cabins were filled with volcanic dust. The scene of ruin was deplorable.

"The captain, though suffering the greatest agony, succeeded in navigating his vessel safely to the port of Castries, St. Lucia, with eighteen dead bodies on the deck and human limbs scattered about. A sailor stood by constantly wiping the captain's injured eyes.

"I think the performance of the *Roddam's* captain was most wonderful, and the more so when I saw his pitiful condition. I do

not understand how he kept up, yet when the steamer arrived at St. Lucia and medical assistance was procured, this brave man asked the doctors to attend to the others first and refused to be treated until this was done.

"My interview with the captain brought out this account. I left him in good spirits and receiving every comfort. The sight of his face would frighten anyone not prepared to see it."

THE VIVID ACCOUNT OF M. ALBERT

To the accounts given by the survivors of the *Roraima* and the officers of the *Etona*, it will be well to add the following graphic story told by M. Albert, a planter of the island, the owner of an estate situated only a mile to the northeast of the burning crater of Mont Pelee. His escape from death had in it something of the marvellous. He says:

"Mont Pelee had given warning of the destruction that was to come, but we, who had looked upon the volcano as harmless, did not believe that it would do more than spout fire and steam, as it had done on other occasions. It was a little before eight o'clock on the morning of May 8 that the end came. I was in one of the fields of my estate when the ground trembled under my feet, not as it does when the earth quakes, but as though a terrible struggle was going on within the mountain. A terror came upon me, but I could not explain my fear.

"As I stood still Mont Pelee seemed to shudder, and a moaning sound issued from its crater. It was quite dark, the sun being obscured by ashes and fine volcanic dust. The air was dead about me, so dead that the floating dust seemingly was not disturbed. Then there was a rending, crashing, grinding noise, which I can only describe as sounding as though every bit of machinery in the

Copyrighted by Judge Publishing Co., 1902.

A PHOTOGRAPHIC PICTURE GIVING GENERAL VIEW OF RUINS OF ST. PIERRE LOOKING TOWARD THE MOUNTAIN.

Copyright, 1902, by W. E. Scull

FIGHTING FOR FOOD AT FORT DE FRANCE AFTER THE ERUPTION OF 1902.
Before the Relief Expedition Arrived.

DEATH OF THE CAPTAIN OF THE RORAIMA AT ST. PIERRE IN 1902.
This heroic captain died the most agonizing death as he tried to steer his boat to safety.
Finally he plunged overboard to quench the flames and perished.

Copyrighted by Judge Publishing Co., 1902.

THE VOLCANIC OUTBREAK OF MT. PELEE, MAY 8, 1902.

The only photograph taken during the height of the eruption, a scene as grand as it was appalling.

world had suddenly broken down. It was deafening, and the flash of light that accompanied it was blinding, more so than any lightning I have ever seen.

"It was like a terrible hurricane, and where a fraction of a second before there had been a perfect calm, I felt myself drawn into a vortex and I had to brace myself firmly. It was like a great express train rushing by, and I was drawn by its force. The mysterious force levelled a row of strong trees, tearing them up by the roots and leaving bare a space of ground fifteen yards wide and more than one hundred yards long. Transfixed I stood, not knowing in what direction to flee. I looked toward Mont Pelee, and above its apex there appeared a great black cloud which reached high in the air. It literally fell upon the city of St. Pierre. It moved with a rapidity that made it impossible for anything to escape it. From the cloud came explosions that sounded as though all of the navies of the world were in titanic combat. Lightning played in and out in broad forks, the result being that intense darkness was followed by light that seemed to be of magnifying power.

"That St. Pierre was doomed I knew, but I was prevented from seeing the destruction by a spur of the hill that shut off the view of the city. It is impossible for me to tell how long I stood there inert. Probably it was only a few seconds, but so vivid were my impressions that it now seems as though I stood as a spectator for many minutes. When I recovered possession of my senses I ran to my house and collected the members of the family, all of whom were panic stricken. I hurried them to the seashore, where we boarded a small steamship, in which we made the trip in safety to Fort de France.

"I know that there was no flame in the first wave that was sent down upon St. Pierre. It was a heavy gas, like firedamp, and

it must have asphyxiated the inhabitants before they were touched by the fire, which quickly followed. As we drew out to sea in the small steamship, Mont Pelee was in the throes of a terrible convulsion. New craters seemed to be opening all about the summit and lava was flowing in broad streams in every direction. My estate was ruined while we were still in sight of it. Many women who lived in St. Pierre escaped only to know that they were left widowed and childless. This is because many of the wealthier men sent their wives away, while they remained in St. Pierre to attend to their business affairs."

WHAT HAPPENED ON THE "HORACE"

The British steamer *Horace* experienced the effect of the explosion when farther from land. After touching at Barbados, she reached the vicinity of Martinique on May 9th, her decks being covered with several inches of dust when she was a hundred and twenty-five miles distant. We quote engineer Anderson's story:

"On the afternoon of May 8 (Thursday) we noticed a peculiar haze in the direction of Martinique. The air seemed heavy and oppressive. The weather conditions were not at all unlike those which precede the great West Indian hurricanes, but, knowing it was not the season of the year for them, we all remarked in the engine room that there must be a heavy storm approaching.

"Several of the sailors, experienced deep water seamen, laughed at our prognostications, and informed us there would be no storm within the next sixty hours, and insisted that, according to all fo'cas'le indications, a dead calm was in sight.

"So unusually peculiar were the weather conditions that we talked of nothing else during the evening. That night, in the direction of Martinique, there was a very black sky, an unusual thing at

this season of the year, and a storm was apparently brewing in a direction from which storms do not come at this season.

GREAT FLASHES OF LIGHT

"As the night wore on those on watch noticed what appeared to be great flashes of lightning in the direction of Martinique. It seemed as though the ordinary conditions were reversed, and even the fo'cas'le prophets were unable to offer explanations.

"Occasionally, over the pounding of the engines and the rush of water, we thought we could hear long, deep roars, not unlike the ending of a deep peal of thunder. Several times we heard the rumble or roar, but at the time we were not certain as to exactly what it was, or even whether we really heard it.

"There would suddenly come great flashes of light from the dark bank toward Martinique. Some of them seemed to spread over a great area, while others appeared to spout skyward, funnel shaped. All night this continued, and it was not until day came that the flashes disappeared. The dark bank that covered the horizon toward Martinique, however, did not fade away with the breaking of day, and at eight in the morning of the 9th (Friday) the whole section of the sky in that direction seemed dark and troubled.

"About nine o'clock Friday morning I was sitting on one of the hatches aft with some of the other engineers and officers of the ship, discussing the peculiar weather phenomena. I noticed a sort of grit that got into my mouth from the end of the cigar I was smoking.

"I attributed it to some rather bad coal which we had shipped aboard, and, turning to Chief Engineer Evans, I remarked that 'that coal was mighty dirty,' and he said that it was covering the ship with a sort of grit. Then I noticed that grit was getting on

my clothes, and finally some one suggested that we go forward of the funnels, so we would not get dirt on us. As we went forward we met one or two of the sailors from the forecastle, who wanted to know about the dust that was falling on the ship. Then we found that the grayish-looking ash was sifting all over the ship, both forward and aft.

ASHES RAINED ON THE SHIP

"Every moment the ashes rained down all over the ship, and at the same time grew thicker. A few moments later, the lookout called down that we were running into a fog-bank dead ahead. Fog banks in that section are unheard of at nine o'clock in the morning at this season, and we were more than a hundred miles from land, and what could fog and sand be doing there.

"Before we knew it, we went into the fog, which proved to be a big dense bank of this same sand, and it rained down on us from every side. Ventilators were quickly brought to their places, and later even the hatches were battened down. The dust became suffocating, and the men at times had all they could do to keep from choking. What the stuff was we could not at first conjecture, or rather, we didn't have much time to speculate on it, for we had to get our ship in shape to withstand we hardly knew what.

"At first we thought that the sand must have been blown from shore. Then we decided that if the Captain's figures were right we wouldn't be near enough to shore to have sand blow on us, and as we had just cleared Barbados, we knew that the Captain's figures had to be right.

"Just as the storm of sand was at its height, Fourth Engineer Wild was nearly suffocated by it, but was easily revived. About this time it became so dark that we found it necessary to start up the electric lights, and it was not until after we got clear from the

fog that we turned the current off. In the meantime they had burned from nine o'clock in the morning until after two in the afternoon.

THE ENGINE BECAME CHOKED

"Then there was another anxious moment shortly after nine o'clock. Third Engineer Rennie had been running the donkey engine, when suddenly it choked, and when he finally got it clear from the sand or ashes, he found the valves were all cut out, and then it was we discovered that it was not sand, but some sort of a composition that seemed to cut steel like emery. Then came the danger that it would get into the valves of the engine and cut them out, and for several moments all hands scurried about and helped make the engine room tight, and even then the ash drifted in and kept all the engine room force wiping the engines clear of it.

"Toward three o'clock in the afternoon of Friday we were practically clear of the sand, but at eleven o'clock that night we ran into a second bank of it, though not as bad as the first. We made some experiments, and found the stuff was superior to emery dust. It cut deeper and quicker, and only about half as much was required to do the work. We made up our minds we would keep what came on board, as it was better than the emery dust and much cheaper, so we gathered it up.

"That night there were more of the same electric phenomena toward Martinique, but it was not until we got into St. Lucia, where we saw the *Roddam*, that we learned of the terrible disaster at St. Pierre, and then we knew that our sand was lava dust."

The volcanic ash which fell on the decks of the *Horace* was ground as fine as rifle powder, and was much finer than that which covered the decks of the *Etona*

Returning to the stories told by officers of the *Roraima*, of which a number have been given, it seems desirable to add here the narrative of Ellery S. Scott, the mate of the ruined ship, since it gives a vivid and striking account of his personal experience of the frightful disaster, with many details of interest not related by others.

MATE SCOTT'S GRAPHIC STORY

"We got to St. Pierre in the *Roraima*," began Mr. Scott, "at 6.30 o'clock on Thursday morning. That's the morning the mountain and the town and the ships were all sent to hell in a minute.

"All hands had had breakfast. I was standing on the fo'c's'l head trying to make out the marks on the pipes of a ship 'way out and heading for St. Lucia. I wasn't looking at the mountain at all. But I guess the captain was, for he was on the bridge, and the last time I heard him speak was when he shouted, 'Heave up, Mr. Scott; heave up.' I gave the order to the men, and I think some of them did jump to get the anchor up, but nobody knows what really happened for the next fifteen minutes. I turned around toward the captain and then I saw the mountain.

"Did you ever see the tide come into the Bay of Fundy. It doesn't sneak in a little at a time as it does 'round here. It rolls in in waves. That's the way the cloud of fire and mud and white-hot stones rolled down from that volcano over the town and over the ships. It was on us in almost no time, but I saw it and in the same glance I saw our captain bracing himself to meet it on the bridge. He was facing the fire cloud with both hands gripped hard to the bridge rail, his legs apart and his knees braced back stiff. I've seen him brace himself that same way many a time in a tough sea with the spray going mast-head high and green water pouring along the decks.

"I saw the captain, I say, at the same instant I saw that ruin coming down on us. I don't know why, but that last glimpse of poor Muggah on his bridge will stay with me just as long as I remember St. Pierre and that will be long enough.

"In another instant it was all over for him. As I was looking at him he was all ablaze. He reeled and fell on the bridge with his face toward me. His mustache and eyebrows were gone in a jiffy. His hat had gone, and his hair was aflame, and so were his clothes from head to foot. I knew he was conscious when he fell, by the look in his eyes, but he didn't make a sound.

"That all happened a long way inside of half a minute; then something new happened. When the wave of fire was going over us, a tidal wave of the sea came out from the shore and did the rest. That wall of rushing water was so high and so solid that it seemed to rise up and join the smoke and flame above. For an instant we could see nothing but the water and the flame.

"That tidal wave picked the ship up like a canoe and then smashed her. After one list to starboard the ship righted, but the masts, the bridge, the funnel and all the upper works had gone overboard.

"I had saved myself from fire by jamming a metal ventilator cover over my head and jumping from the fo'c's'l head. Two St. Kitts negroes saved me from the water by grabbing me by the legs and pulling me down into the fo'c's'l after them. Before I could get up three men tumbled in on top of me. Two of them were dead.

"Captain Muggah went overboard, still clinging to the fragments of his wrecked bridge. Daniel Taylor, the ship's cooper, and a Kitts native jumped overboard to save him. Taylor managed to push the captain on to a hatch that had floated off from us and then they swam back to the ship for more assistance, but nothing could be

done for the captain. Taylor wasn't sure he was alive. The last we saw of him or his dead body it was drifting shoreward on that hatch.

"Well, after staying in the fo'c's'l about twenty minutes, I went out on deck. There were just four of us left aboard who could do anything. The four were Thompson, Dan Taylor, Quashee, and myself. It was still raining fire and hot rocks and you could hardly see a ship's length for dust and ashes, but we could stand that. There were burning men and some women and two or three children lying around the deck. Not just burned, but burning, then, when we got to them. More than half the ship's company had been killed in that first rush of flame. Some had rolled overboard when the tidal wave came and we never saw so much as their bodies. The cook was burned to death in his galley. He had been paring potatoes for dinner and what was left of his right hand held the shank of his potato knife. The wooden handle was in ashes. All that happened to a man in less than a minute. The donkey engineman was killed on deck sitting in front of his boiler. We found parts of some bodies—a hand, or an arm or a leg. Below decks there were some twenty alive.

"The ship was on fire, of course, what was left of it. The stumps of both masts were blazing. Aft she was like a furnace, but forward the flames had not got below deck, so we four carried those who were still alive on deck into the fo'c's'l. All of them were burned and most of them were half strangled.

"One boy, a passenger and just a little shaver [the four-year-old son of the late Clement Stokes, above spoken of] was picked up naked. His hair and all his clothing had been burned off, but he was alive. We rolled him in a blanket and put him in a sailor's bunk. A few minutes later we looked at him and he was dead.

"My own son's gone, too. It had been his trick at lookout ahead during the dog watch that morning, when we were making for St. Pierre, so I supposed at first when the fire struck us that he was asleep in his bunk and safe. But he wasn't. Nobody could tell me where he was. I don't know whether he was burned to death or rolled overboard and drowned. He was a likely boy. He had been several voyages with me and would have been a master some day. He used to say he'd make me mate.

"After getting all hands that had any life left in them below and 'tended to the best we could, the four of us that were left half way ship-shape started in to fight the fire. We had case oil stowed forward. Thanks to that tidal wave that cleared our decks there wasn't much left to burn, so we got the fire down so's we could live on board with it for several hours more and then the four turned to to knock a raft together out of what timber and truck we could find below. Our boats had gone overboard with the masts and funnel.

PREPARED TO TRUST TO LUCK

"We made that raft for something over thirty that were alive. We put provisions on for two days and rigged up a make-shift mast and sail, for we intended to go to sea. We were only three boats' length from the shore, but the shore was hell itself. We intended to put straight out and trust to luck that the *Korona*, that was about due at St. Pierre, would pick us up. But we did not have to risk the raft, for about 3 o'clock in the afternoon, when we were almost ready to put the raft overboard, the *Suchet* came along and took us all off. We thought for a minute just after we were wrecked that we were to get help from a ship that passed us. We burned blue lights, but she kept on. We learned afterward that she was the *Roddam*."

Soundings made off Martinique after the explosion showed that earthquake effects of much importance had taken place under the sea bottom, which had been lifted in some places and had sunk in others. While deep crevices had been formed on the land, a still greater effect had seemingly been produced beneath the water. During the explosion the sea withdrew several hundred feet from its shore line, and then came back steaming with fury; this indicating a lift and fall of the ocean bed off the isle. Soundings made subsequently near the island found in one place a depth of 4,000 feet where before it had been only 600 feet deep. The French Cable Company, which was at work trying to repair the cables broken by the eruption, found the bottom of the Caribbean Sea so changed as to render the old charts useless.

New charts will need to be made for future navigation. The changes in sea levels were not confined to the immediate centre of volcanic activity, but extended as far north as Porto Rico, and it was believed that the seismic wave would be found to have altered the ocean bed round Jamaica. Vessels plying between St. Thomas, Martinique, St. Lucia and other islands found it necessary to heave the lead while many miles at sea.

It is estimated that the sea had encroached from ten feet to two miles along the coast of St. Vincent near Georgetown, and that a section on the north of the island had dropped into the sea. Soundings showed seven fathoms where before the eruption there were thirty-six fathoms of water. Vessels that endeavored to approach St. Vincent toward the north reported that it was impossible to get nearer than eight miles to the scene of the catastrophe, and that at that distance the ocean was seriously perturbed as from a submarine volcano boiling and hissing continually

In this connection the remarkable experience reported by the officers of the Danish steamship *Nordby*, on the day preceding the eruption, is of much interest, as seeming to show great convulsions of the sea bottom at a point several hundred miles from Martinique. The following is the story told by Captain Eric Lillienskjold:

THE STRANGE EXPERIENCE OF THE "NORDBY"

"On May 5th," the captain said, "we touched at St. Michael's for water. We had had an easy voyage from Girgenti, in Sicily, and we wanted to finish an easy run here. We left St. Michael's on the same day. Nothing worth while talking about occurred until two days afterward—Wednesday, May 7th.

"We were plodding along slowly that day. About noon I took the bridge to make an observation. It seemed to be hotter than ordinary. I shed my coat and vest and got into what little shade there was. As I worked it grew hotter and hotter. I didn't know what to make of it. Along about 2 o'clock in the afternoon it was so hot that all hands got to talking about it. We reckoned that something queer was coming off, but none of us could explain what it was. You could almost see the pitch softening in the seams.

"Then, as quick as you could toss a biscuit over its rail, the *Nordby* dropped—regularly dropped—three or four feet down into the sea. No sooner did it do this than big waves, that looked like they were coming from all directions at once, began to smash against our sides. This was queerer yet, because the water a minute before was as smooth as I ever saw it. I had all hands piped on deck, and we battened down everything loose to make ready for a storm. And we got it all right—the strangest storm you ever heard tell of.

"There was something wrong with the sun that afternoon. It grew red and then dark red and then, about a quarter after 2, it went out of sight altogether. The day got so dark that you couldn't see half a ship's length ahead of you. We got our lamps going, and put on our oilskins, ready for a hurricane. All of a sudden there came a sheet of lightning that showed up the whole tumbling sea for miles and miles. We sort of ducked, expecting an awful crash of thunder, but it didn't come. There was no sound except the big waves pounding against our sides. There wasn't a breath of wind.

"Well, sir, at that minute there began the most exciting time I've ever been through, and I've been on every sea on the map for twenty-five years. Every second there'd be waves 15 or 20 feet high, belting us head-on, stern-on and broadside, all at once. We could see them coming, for without any stop at all flash after flash of lightning was blazing all about us.

"Something else we could see, too. Sharks! There were hundreds of them on all sides, jumping up and down in the water. Some of them jumped clear out of it. And sea birds! A flock of them, squawking and crying, made for our rigging and perched there. They seemed like they were scared to death. But the queerest part of it all was the water itself. It was hot—not so hot that our feet could not stand it when it washed over the deck, but hot enough to make us think that it had been heated by some kind of a fire.

"Well that sort of thing went on hour after hour. The waves, the lightning, the hot water and the sharks, and all the rest of the odd things happening, frightened the crew out of their wits. Some of them prayed out loud—I guess the first time they ever did in their lives. Some Frenchmen aboard kept running around and

yelling, '*C'est le dernier jour!*' (This is the last day.) We were all worried. Even the officers began to think that the world was coming to an end. Mighty strange things happen on the sea, but this topped them all.

"I kept to the bridge all night. When the first hour of morning came the storm was still going on. We were all pretty much tired out by that time, but there was no such thing as trying to sleep. The waves still were batting us around and we didn't know whether we were one mile or a thousand miles from shore. At 2 o'clock in the morning all the queer goings on stopped just the way they began—all of a sudden. We lay to until daylight; then we took our reckonings and started off again. We were about 700 miles off Cape Henlopen.

"No, sir; you couldn't get me through a thing like that again for $10,000. None of us was hurt, and the old *Nordby* herself pulled through all right, but I'd sooner stay ashore than see waves without wind and lightning without thunder."

FIERY STREAM CONTAINED POISONOUS GASES

Careful inspection showed that the fiery stream which so completely destroyed St. Pierre must have been composed of poisonous gases, which instantly suffocated every one who inhaled them, and of other gases burning furiously, for nearly all the victims had their hands covering their mouths, or were in some other attitude showing that they had perished from suffocation.

It is believed that Mont Pelee threw off a great gasp of some exceedingly heavy and noxious gas, something akin to firedamp, which settled upon the city and rendered the inhabitants insensible. This was followed by the sheet of flame that swept down the side of the mountain. This theory is sustained by the experience of the

survivors who were taken from the ships in the harbor, as they say that their first experience was one of faintness.

The dumb animals were wiser than man, and early took warning of the storm of fire which Mont Pelee was storing up to hurl upon the island. Even before the mountain began to rumble, late in April, live stock became uneasy, and at times were almost uncontrollable. Cattle lowed in the night. Dogs howled and sought the company of their masters, and when driven forth they gave every evidence of fear.

Wild animals disappeared from the vicinity of Mont Pelee. Even the snakes, which at ordinary times are found in great numbers near the volcano, crawled away. Birds ceased singing and left the trees that shaded the sides of Pelee. A great fear seemed to be upon the island, and though it was shared by the human inhabitants, they alone neglected to protect themselves.

Of the villages in the vicinity of St. Pierre only one escaped, the others suffering the fate of the city. The fortunate one was Le Carbet, on the south, which escaped uninjured, the flood of lava stopping when within two hundred feet of the town. Morne Rouge, a beautiful summer resort, frequented by the people of the island during the hot season as a place of recreation, also escaped. In the height of the season several thousand people gathered there, though at the time of the explosion there were but a few hundred. Though located on an elevation between the city and the crater, it was by great good fortune saved.

The Governor of Martinique, Mr. Mouttet, whose precautions to prevent the people fleeing from the city aided to make the work of death complete, was himself among the victims of the burning mountain. With him in this fate was Colonel Dain, commander of the troops who formed a cordon round the doomed city.

CHAPTER XXXII.

Submarine Volcanoes and their Work of Island Building.

IN November, 1867, a volcano suddenly began to show signs of activity beneath the deep sea of the Pacific Ocean. There are some islands nearly two thousands miles to the east of Australia called the Navigator's Group, in which there had been no history of an eruption, nor had such an event been handed down by tradition. Most of the islands in the Pacific Ocean are old volcanoes, or are made up of rocks cast forth from extinct burning mountains. They rise up like peaks through the great depths of the ocean, and the top, which just appears above the sea-level, is generally encircled by a growth of coral. Hence they are termed coral islands. These islands every now and then rise higher than the sea-level, owing to some deep upheaving force, and then the coral is lifted up above the water, and become a solid rock. But occasionally the reverse of this takes place, and the islands begin to sink into the sea, owing to a force which causes the base of the submarine mountain to become depressed. Some times they disappear. All this shows that some great disturbing forces are in action at the bottom of the sea, and just within the earth's crust, and that they are of a volcanic nature.

For some time before the eruption in question, earthquakes shook the surrounding islands of the Navigator's Group, and caused great alarm, and when the trembling of the earth was very

great, the sea began to be agitated near one of the islands, and vast circles of disturbed water were formed. Soon the water began to be forced upwards, and dead fish were seen floating about After a while, steam rushed forth, and jets of mud and volcanic sand. Moreover, when the steam began to rush up out of the water, the violence of the general agitation of the land and of the surface of the sea increased.

AN ERUPTION DESCRIBED

When the eruption was at its height vast columns of mud and masses of stone rushed into the air to a height of 2,000 feet, and the fearful crash of masses of rock hurled upwards and coming in collision with others which were falling attested the great volume of ejected matter which accumulated in the bed of the ocean, although no trace of a volcano could be seen above the surface of the sea. Similar submarine volcanic action has been observed in the Atlantic Ocean, and crews of ships have reported that they have seen in different places sulphurous smoke, flame, jets of water, and steam, rising up from the sea, or they have observed the waters greatly discolored and in a state of violent agitation, as if boiling in large circles.

New shoals have also been encountered, or a reef of rocks just emerging above the surface, where previously there was always supposed to have been deep water. On some few occasions, the gradual building up of an island by submarine volcanoes has been observed, as that of Sabrina in 1181, off St. Michael's, in the Azores. The throwing up of ashes in this case, and the formation of a conical hill 300 feet high, with a crater out of which spouted lava and steam, took place very rapidly. But the waves had the best of it, and finally washed Sabrina into the depths of the ocean.

Previous eruptions in the same part of the sea were recorded as having happened in 1691 and 1720.

In 1831, a submarine volcanic eruption occurred in the Mediterranean Sea, between Sicily and that part of the African coast where Carthage formerly stood. A few years before, Captain Smyth had sounded the spot in a survey of the sea ordered by Government, and he found the sea-bottom to be under 500 feet of water. On June 28, about a fortnight before the eruption was visible, Sir Pulteney Malcom, in passing over the spot in his ship, felt the shock of an earthquake as if he had struck on a sandbank, and the same shocks were felt on the west coast of Sicily, in a direction from south-west to north-east.

BUILDING UP OF AN ISLAND BY SUBMARINE VOLCANOES

About July 10, the captain of a Sicilian vessel reported that as he passed near the place he saw a column of water like a water-spout, sixty feet high, and 800 yards in circumference, rising from the sea, and soon after a dense rush of steam in its place, which ascended to the height of 1,800 feet. The same captain, on his return eighteen days after, found a small island twelve feet high, with a crater in its centre, throwing forth volcanic matter and immense columns of vapor, the sea around being covered with floating cinders and dead fish. The eruption continued with great violence to the end of the same month. By the end of the month the island grew to ninety feet in height, and measured three-quarters of a mile round. By August 4th it became 200 feet high and three miles in circumference; after which it began to diminish in size by the action of the waves. Towards the end of October the island was levelled nearly to the surface of the sea.

Naval officers and foreign ministers alike took an absorbing interest in this new island. The strong national thirst for territory manifested itself and eager mariners waited only till the new land should be cool enough to set foot on to strive who should be first to plant there his country's flag. Names in abundance were given it by successive observers,—Nerita, Sciacca, Fernandina, Julia, Hotham, Corrao, and Graham. The last holds good in Eng-

GRAHAM'S ISLAND
Uplift of a Submarine Volcano

lish speech, and as Graham's Island it is known in books to-day, though the sea took back what it had given, leaving but a shoal of cinders and sand.

The Bay of Santorin, in the island of that name, which lies immediately to the north of Crete, has long been noted for its submarine volcanoes. According to one account, indeed, the whole island was at a remote period raised from the bottom of the sea;

but this is questionable. It is, with more reason, supposed that the bay is the site of an ancient crater, which was situated on the summit of a volcanic cone that subsequently fell in. Certain it is that islands have from time to time been thrown up by volcanic forces from the bottom of the sea within this bay, and that some of them have remained, while others have sunk again.

HOW AN ISLAND GREW

Of the existing islands, some were thrown up shortly before the beginning of the Christian era; in particular, one called the Great Cammeni, which, however, received a considerable accession to its size by a fresh eruption in A. D. 726. The islet nearest Santorin was raised in 1573, and was named the Little Cammeni; and in 1707 there was added, between the other two, a third, which is now called the Black Island. This made its appearance above water on the 23rd of May, 1707, and was first mistaken for a wreck; but some sailors, who landed on it, found it to be a mass of rock; consisting of a very white soft stone, to which were adhering quantities of fresh oysters. While they were collecting these, a violent shaking of the ground scared them away.

During several weeks the island gradually increased in volume; but in July, at a distance of about sixty paces from the new islet, there was thrown up a chain of black calcined rocks, followed by volumes of thick black smoke, having a sulphurous smell. A few days thereafter the water all around the spot became hot, and many dead fishes were thrown up. Then, with loud subterraneous noises, flames arose, and fresh quantities of stones and other substances were ejected, until the chain of black rocks became united to the first islet that had appeared. This eruption continued for a long time, there being thrown out quantities of ashes and pumice, which

covered the island of Santorin and the surface of the sea—some being drifted to the coasts of Asia Minor and the Dardanelles. The activity of this miniature volcano was prolonged, with greater or less energy, for about ten years.

In 1866 similar phenomena took place in the Bay of Santorin, beginning with underground sounds and slight shocks of earthquake, which were followed by the appearance of flames on the surface of the sea. Soon after there arose, out of a dense smoke, a small islet, which gradually increased until in a week's time it was 60 feet high, 200 long and 90 wide. The people of Santorin named it "George," in honor of the King of Greece. In another week it joined and became continuous with the Little Cammeni. The detonations increased in loudness, and large quantities of incandescent stones were thrown up from the crater.

About the same time, at the distance of nearly 150 feet from the coast, to the westward of a point called Cape Phlego, there rose from the sea another island, to which was given the name of Aphroessa. It sank and reappeared several times before it established itself above water. The detonations and ejection of incandescent lava and stones continued at intervals during three weeks. From the crater of the islet George, which attained a height of 150 feet, some stones several cubic yards in bulk were projected to a great distance. One of them falling on board of a merchant vessel, killed the captain and set fire to the ship.

By the 10th of March the eruptions had partially subsided, but were then renewed, and a third island, which was named Reka, rose alongside of Aphroessa. They were at first separated by a channel sixty feet deep; but in three days this was filled up, and the two islets became united.

Reference may properly be made here to Monte Nuovo and Jorullo, not that they appertain to the present subject, but that they form examples of the action of similar forces, in the one instance exerted on a lake bottom, in the other on dry land, each yielding permanent volcanic elevations in every respect analogous to those which rise as islands from the bottom of the sea.

IN THE ICELANDIC SEAS

Off the coast of Iceland islands have appeared during several of the volcanic eruptions which that remote dependency of Denmark has manifested, and at various periods in Iceland's history the sea has been covered with pumice and other debris, which tell their own tale of what has been going on, without being in sufficient quantity to reach the surface in the form of an island mass. The sea off Reykjanes—Smoky Cape, as the name means—has been a frequent scene of these submarine eruptions. In 1240, during what the Icelandic historians describe as the eighth outburst, a number of islets were formed, though most of them subsequently disappeared, only to have their places occupied by others born at a later date. In 1422 high rocks of considerable circumference appeared. In 1783, about a month before the eruption of Skaptar Jökull, a volcanic island named Nyoe, from which fire and smoke issued, was built up. But in time it vanished under the waves, all that remains of it to-day being a reef from five to thirty-five fathoms below the sea-level. In 1830, after several long-continued eruptions of the usual character, another isle arose; while at the same time the skerries known as the Geirfuglaska disappeared, and with them vanished the great auks, or gare-fowls—birds now extinct—which up to that time had bred on them. At all events, though the auks could not well have been drowned, no traces of them were seen after the date mentioned.

In July, 1884, an island again appeared about ten miles off Reykjanes; but it is already beginning to diminish in size, and may soon disappear.

OFF THE COAST OF ALASKA

Elsewhere in the region of the northern seas there are other instances of the influence of the submarine forces in raising up and lowering land. The coast of Alaska is a region of intense volcanic action. In 1795, during a period of volcanic activity in the craters of Makushina, on Unalaska, and in others on Umnak Island, a volume of smoke was seen to rise out of the sea about 42 miles to the north of Unalaska, and the next year it was followed by a heap of cindery material, from which arose flame and volcanic matter, the glow being visible over a radius of ten miles. In four years the island grew into a large cone, 3000 feet above the sea-level, and two or three miles in circumference. Two years later it was still so hot that when some hunters landed on it they found the soil too warm for walking. It was named Ionna Bogoslova (St. John the Theologian), by the Russians, Agashagok by the Aleuts, and is now known to the whites of that region as Bogosloff. Mr. Dall believes that it occupies the site of some rocks that existed there as long as tradition extends.

There were additions to the cone up to the year 1823, when it became so quiescent as to be the favorite haunt of seals and sea-fowls, and, when the weather was favorable, was visited by native egg-hunters from Unalaska. During the summer of 1883 Bogosloff was again seen in eruption, as it was thought. However, on closely examining the neighborhood, it was found that the old island was undisturbed, but that there had been a fresh eruption, which had resulted in the extension of Bogosloff by the appearance of a cone and crater (Hague Volcano), 357 feet high, connected

with the parent island by a low sand-spit, and situated in a spot where, the year before, the lead showed 800 fathoms of water. At the same time Augustin and two other previously quiet islands on the peninsula of Alaska began simultaneously to emit smoke, dust and ashes, while a reef running westward and formerly submerged became elevated to the sea surface. Other islands, of origin exactly similar to Bogosloff and those mentioned, are to be found in this region, notably Koniugi and Kasatochi, in the western Aleutians, and Pinnacle Island, near St. Matthew Island. Indeed, the volcano of Kliutchevsk, which rises to a height of over 15,000 feet, is really a volcanic island.

A permanent addition was made to the Aleutian group of Islands by the action of a submarine volcano in 1806. This new island has the form of a volcanic peak, with several subsidiary cones. It is four geographical miles in circumference. In 1814 another arose out of the sea in the same archipelago, the cone of which attained a height of 3,000 feet; but at the end of a year it lost a portion of this elevation.

In 1856, in the sea in the same neighborhood, Captain Newell, of the whaling bark *Alice Fraser*, witnessed a submarine eruption, which was also seen by the crews of several other vessels. There was no island formed on this occasion, but large jets of water were thrown up, and the sea was greatly agitated all around. Then followed volcanic smoke, and quantities of stones, ashes, and pumice; the two latter being scattered over the surface of the sea to a great distance. Loud thundering reports accompanied this eruption, and all the ships in the neighborhood felt concussions like those produced by an earthquake. These phenomena seem to have ended in the formation of some great submarine chasm, into which the waters rushed with extreme violence and a terrific roar.

Occurrences similar to this last have been several times observed in a tract of open sea in the Atlantic, about half a degree south of the equator, and between 20° and 22° of west longitude. Although quantities of volcanic dross have been from time to time thrown up to the surface in this region, no island has yet made its appearance above water.

The events here described repeat on a far smaller scale similar ones which have occurred in remote ages in many parts of the ocean and left great island masses as the permanent effects of their work. We may instance the Hawaiian group, which is wholly of volcanic origin, with the exception of its minor coral additions, and represents a stupendous activity of underground agencies beneath the domain of Father Neptune.

In part, as we have said elsewhere in this work, all oceanic islands, remote from those in the shoal bordering waters of the continents, have been of volcanic or coral formation, or more often a combination of the two. No sooner does an island mass appear above or near the surface of tropical waters than the minute coral animals—effective only by their myriads—begin their labors, building fringes of coral rock around the cindery heaps lifted from the ocean floor. The atolls of the Pacific—circular or oval rings of coral with lagunes of sea-water within—have long been thought to be built on the rims of submarine volcanoes, rising to within a few hundred feet of the surface, much as coral reefs around actual islands. If the volcanic mass should subsequently subside, as it is likely to do, the minute ocean builders will continue their work—unless the subsidence be too rapid for their powers of production—and in this way ring-like islands of coral may in time rise from great depths of sea, their basis being the volcanic island which has sunk from near the surface far toward old ocean's primal floor.

CHAPTER XXXIII.

Mud Volcanoes, Geysers, and Hot Springs.

OUR usual impression of a volcano is indicated in the title of "burning mountain," so often employed, a great fire-spouting cone of volcanic debris, from which steam, lava, rock-masses, cinder-like fragments, and dust, often of extreme fineness, are flung high into the air or flow in river-like torrents of molten rock. This, no doubt, applies in the majority of cases, but the volcanic forces do not confine themselves to these magnificent displays of energy, nor are their products limited to those above specified. We have seen that mud is a not uncommon product, due to the mingling of water with volcanic dust, while water alone is occasionally emitted, of which we have a marked instance in the Volcan de Agua, of Guatemala, already mentioned. As regards mud flows, we may specially instance the first outflow from Mont Pelee, that by which the Guerin sugar works were overwhelmed.

The imprisoned forces of the earth have still other modes of manifestation. A very frequent one of these, and the most destructive to human life of them all, is the earthquake.

Minor manifestations of volcanic action may be seen in the geyser and the hot spring, the latter the most widely disseminated of all the resultant effects of the heated condition of the earth's interior. It is these displays of subterranean energy, differing from those usually termed volcanic, yet due to the same general causes, that we have next to consider. And it may be premised that their

manifestations, while, except in the case of the earthquake, less violent, are no less interesting, especially as the minor displays are free from that peril to human life which renders the major ones so terrible.

While the largest volcanoes at times pour out rivers of liquid mud, there are volcanoes from which nothing is ever ejected but mud and water, the latter being generally salt. From this circumstance they are sometimes called *salses*, but they are more generally termed mud-volcanoes. Some varieties of them throw out little else than gases of different sorts, and these are called air-volcanoes.

THE GREAT MUD VOLCANO OF SICILY

One of the best known mud-volcanoes is at Macaluba, near Girgenti, in Sicily. It consists of several conical mounds, varying from time to time in their form and height, which ranges from eight to thirty feet. From orifices on the tops of these mounds there are thrown out sometimes jets of warmish water and mud mixed with bitumen, sometimes bubbles of gas, chiefly carbonic acid and carburetted hydrogen, occasionally pure nitrogen. The mud ejected has often a strong sulphurous smell. The jets in general ascend only to a moderate height; but occasionally they are thrown up with great violence, attaining a height of about 200 feet. In 1777 there was ejected an immense column, consisting of mud strongly impregnated with sulphur and mixed with naphtha and stones, accompanied also by quantities of sulphurous vapors. This mud-volcano is known to have been in action for fifteen centuries.

Very recently a small mud-volcano has been formed on the flanks of Mount Etna. It began with the throwing up of jets of boiling water, mixed with petroleum and mud, great quantities of gas bubbling up at the same time. In several of the valleys of

Iceland there are similar phenomena, the boiling water and mud being thrown up in jets to the height of fifteen feet and upwards, the mud accumulating around the orifices whence the jets arise.

A mud-volcano named Korabetoff, in the Crimea, presents phenomena more akin to those of the igneous volcanoes of South America. There was an eruption from this mountain on the 6th of August, 1853. It began by throwing up from the summit a column of fire and smoke, which ascended to a great height. This continued for five or six minutes, and was followed at short intervals by two similar eruptions. There was then ejected with a hissing noise a quantity of black fetid mud, which was so hot as to scorch the grass on the edges of the stream. The mud continued to pour out for three hours, covering a wide space at the mountain's base. The mud-volcanoes on the coast of Beloochistan are very numerous, and extend over an area of nearly a thousand square miles. Their action resembles that at Macaluba.

THE MUD VOLCANO OF JAVA

There is a mud volcano in Java which is of interest as somewhat resembling the geyser in its mode of operation and apparently due to similar agencies. It is thus described by Dr. Horsfield:—

"On approaching it from a distance, it is first discovered by a large volume of smoke, rising and disappearing at intervals of a few seconds, resembling the vapors rising from a violent surf. A loud noise is heard, like that of distant thunder. Having advanced so near that the vision was no longer impeded by the smoke, a large hemispherical mass was observed, consisting of black earth mixed with water, about sixteen feet in diameter, rising to the height of twenty or thirty feet in a perfectly regular manner, and as if it were pushed up by a force beneath, which suddenly exploded with a loud

noise, and scattered about a volume of black mud in every direction. After an interval of two or three, or sometimes four or five seconds, the hemispherical body of mud rose and exploded again. In the manner stated this volcanic ebullition goes on without interruption, throwing up a globular body of mud, and dispersing it with violence through the neighboring plain. The spot where the ebullition occurs is nearly circular, and perfectly level. It is covered only with the earthy particles, impregnated with salt water, which are thrown up from below. The circumference may be estimated at about half an English mile. In order to conduct the salt water to the circumference, small passages or gutters are made in the loose muddy earth, which lead to the borders, where it is collected in holes dug in the ground for the purpose of evaporation."

The mud has a strong, pungent, sulphurous smell, resembling that of mineral oil, and is hotter than the surrounding atmosphere. During the rainy season the explosions increase in violence.

There are submarine mud volcanoes as well as those of igneous kind. In 1814 one of this character broke out in the Sea of Azof, beginning with flame and black smoke, accompanied by earth and stones, which were flung to a great height. Ten of these explosions occurred, and, after a period of rest, others were heard during the night. The next morning there was visible above the water an island of mud some ten feet high. A very similar occurrence took place in 1827, near Baku, in the Caspian sea. This began with a flaming display and the ejection of great fragments of rock. An eruption of mud succeeded. A set of small volcanoes discovered by Humboldt in Turbaco, in South America, confined their emissions almost wholly to gases, chiefly nitrogen.

There is a close connection in character between mud volcanoes and those intermittent boiling springs named geysers. A good many

of the mud volcanoes throw out jets of boiling water along with the mud; but in the case of the geysers, the boiling water is ejected alone, without any visible impregnation, though some mineral in solution, as silica, carbonate of lime, or sulphur, is usually present.

THE GEYSER IS A WATER VOLCANO

The phenomenon of the geyser serves in a measure to support the theory that steam is an important agent in volcanic action. A geyser, in fact, may be designated as a water volcano, since it throws up water only. It comprises a cone or mound, usually only a few feet high. In the middle of this is a crater-like opening with a passage leading down into the earth. As in the case of the volcano, the geyser cone is built up by its own action. In the boiling water which is ejected there is dissolved a certain amount of silica. As the water falls and cools this mineral is deposited, gradually building up a cup-like elevation. The basin of the geyser is generally full of clear water, with a little steam rising from its surface; but at intervals an eruption takes place, sometimes at regular periods, but more often at irregular intervals.

Among the largest and best known geysers in the world are those of Iceland, chief among them being the Great Geyser. Silica is the mineral with which the waters of this fountain are impregnated, and the substance which they deposit, as they slowly evaporate, is named siliceous sinter. Of this material is composed the mound, six or seven feet high, on which the spring is situated. On the top of the mound is a large oval basin, about three feet in depth, measuring in its larger diameter about fifty-six, and in its shorter about forty-six feet. The centre of this basin is occupied by a circular well about ten feet in diameter, and between seventy and eighty feet deep.

Out of the central well springs a jet of boiling water, at intervals of six or seven hours. When the fountain is at rest, both the basin and the well appear quite empty, and no steam is seen. But on the approach of the moment for action, the water rises in the well, till it flows over into the basin. Then loud subterranean explosions are heard, and the ground all round is violently shaken.

Instantly, and with immense force, a steaming jet of boiling water, of the full width of the well, springs up and ascends to a great height in the air. The top of this large column of water is enveloped in vast clouds of steam, which diffuse themselves through the air, rendering it misty. These jets succeed each other with great rapidity to the number of sixteen or eighteen, the period of action of the fountain being about five minutes. The last of the jets generally ascends to the greatest height, usually to about 100, but sometimes to 150 feet; on one occasion it rose to the great height of 212 feet. Having ejected this great column of water, the action ceases, and the water that had filled the basin sinks down into the well. There it remains till the time for the next eruption, when the same phenomena are repeated. It has been found that, by throwing large stones into the well, the period of the eruption may be hastened, while the loudness of the explosions and the violence of the fountain effect are increased, the stones being at the same time ejected with great force.

ERUPTION CAN BE INDUCED BY ARTIFICIAL MEANS

Geysers are found all over the island, presenting various peculiarities. In the case of one of the smaller ones, which is called Strokr, or the Churn, an eruption can be induced by artificial means. A barrow-load of sods is thrown into the crater of the geyser, with the effect of causing an eruption. The sensitiveness of Strokr is

due to its peculiar form. An observer states that, "The bore is eight feet in diameter at the top, and forty-four feet deep. Below twenty-seven feet it contracts to nineteen inches, so that the turf thrown in completely chokes it. Steam collects below; a foaming scum covers the surface of the water, and in a quarter of an hour it surges up the pipe. The fountain then begins playing, sending its bundles of jets rather higher than those of the Great Geyser, flinging up the clods of turf which have been its obstruction like a number of rockets. This magnificent display continues for a quarter of an hour or twenty minutes. The erupted water flows back into the pipe from the curved sides of the bowl. This occasions a succession of bursts, the last expiring effort, very generally, being the most magnificent. Strokr gives no warning thumps, like the Great Geyser, and there is not the same roaring of steam accompanying the outbreak of the water."

The same author thus describes an eruption of the Great Geyser, which occurred about two o'clock in the morning: "A violent concussion of the ground brought me and my companions to our feet. We rushed out of the tent in every condition of dishabille and were in time to see Geyser put forth his full strength. Five strokes underground were the signal, then an overflow, wetting every side of the mound. Presently a dome of water rose in the centre of the basin and fell again, immediately to be followed by a fresh bell, which sprang into the air fully forty feet high, accompanied by a roaring burst of steam. Instantly the fountain began to play with the utmost violence, a column rushing up to the height of ninety or one hundred feet against the gray night sky, with mighty volumes of white steam cloud rolling after it and swept off by the breeze to fall in torrents of hot rain. Jets and lines of water tore their way through the clouds, or leaped high

above its domed mass. The earth trembled and throbbed during the explosion, then the column sank, started up again, dropped once more, and seemed to be sucked back into the earth. We ran to the basin, which was left dry, and looked down the bore at the water, which was bubbling at the depth of six feet."

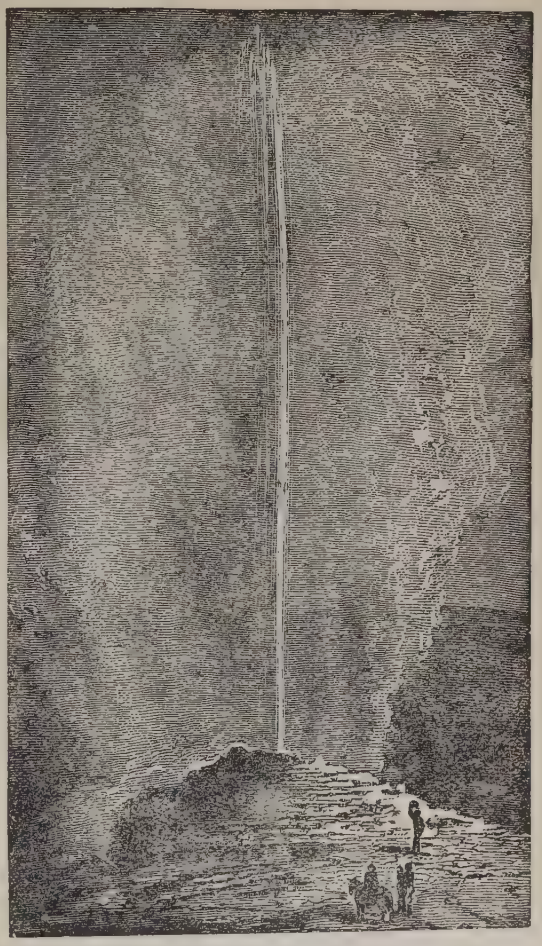
In the case of Strokr, the cause of this eruption is not difficult to understand. The narrow part of the channel is choked up by the turf and the steam, and prevented from escaping. Finally it gains such force as to drive out the obstacle with a violent explosion, just as a bottle of fermenting liquor may blow out the cork and discharge some of its contents.

Geysers are somewhat abundant phenomena, existing in many parts of the earth, while striking examples of them are found in the widely separated regions of Iceland, New Zealand, Japan and the western United States. In the volcanic region of New Zealand geysers and their associated hot springs are abundant. It was to their action that we owed the famous white and pink terraces and the warm lake of Rotomahana which were ruined by the destructive eruption of Mount Tarawera, already described.

GEYSERS OF THE UNITED STATES

The United States is abundantly supplied with hot springs, but geysers, outside of the Yellowstone region, are found only in California and Nevada. Those of California exist chiefly in Napa Valley, north of San Francisco, in a canon or defile. Their waters are impregnated not with silica, but with sulphur, and they thus approach more nearly in their character to mud-volcanoes, whose ejections are, in like manner, much impregnated with that sub stance. They are also, like them, collected in groups, there being no less than one hundred openings within a space of flat ground a

mile square. Owing to their number and proximity, their individual energy is nothing like so violent as that of the geysers of Iceland. Their jets seldom rise higher than 20 or 30 feet; but so great a number playing within so confined a space produces an imposing effect. The jets of boiling water issue with a loud noise from little conical mounds, around which the ground is merely a crust of sulphur. When this crust is penetrated, the boiling water may be seen underneath. The rocks in the neighborhood of these fountains are all corroded by the action of the sulphurous vapors. Nevertheless, within a distance of not more than 50 feet from them, trees grow without injury to their health.



A GEYSER IN ERUPTION, YELLOWSTONE NATIONAL PARK.

Few of these fountains, however, are regular geysers, most of them discharging only steam. From the Steamboat Geyser this ascends to a height of from 50 to 100 feet, with a roar like that of the escape from a steamboat boiler. Associated with the geysers are numerous hot springs.

some clear, some turbid, and variously impregnated with iron, sulphur or alum. In Nevada the Steamboat Springs, as they are designated, exist in Washoe Valley, east of the Virginian range. They come nearer in character to the Yellowstone geysers, their waters depositing true geyserite, or silicious concretions. The Volcano Springs, in Lauder County, are also true geysers, though of small importance. The ground here is so thickly perforated by holes from which steam escapes that it looks like a cullender.

THE YELLOWSTONE GEYSERS

The most remarkable geyser country in the world, alike for the size and the number of its spouting fountains, is the Yellowstone region in the northwest part of the Territory of Wyoming, in the United States, which, by a special act of Congress, has been reserved as the Yellowstone National Park, exempt from settlement, purchase or pre-emption. Here nearly every form of geyser and unintermittent hot spring occurs, with deposits of various kinds, silicious, calcareous, etc. Of the hot springs, Dr. Peale enumerates 2,195, and considers that within the limits of the park—which is about 54 miles by 62 miles, and includes 3,312 square miles—as many as 3,000 actually exist. The same geologist notes the existence of 71 geysers in the area mentioned, though some of the number are only inferred to be spouting springs from the form of their basins and the character of the surrounding deposits. Of this vast collection of still and eruptive springs, between which there seems every gradation, those which do not send water into the air are, owing to the magnificent cascades which they form, often quite as remarkable as those which take the shape of geysers. The more striking of the latter may, however, be briefly mentioned.

In the Gibbon Basin is a geyser of late origin. In 1878 this consisted of two steam holes, roaring on the side of a hill, that looked as if they had recently burst through the surface; and the gully leading towards the ravine was at that date filled with sand, which appeared to have been poured out during an eruption. Dead trees stood on the line of this sand floor, and others, with their bark still remaining, and even with their foliage not lost, were uprooted hard by, everything indicating that the "steamboat vent," as it was called, was of recent formation. In 1875 it had no existence, but in 1879 the spouting spring — which first opened, it is believed, on the 11th of August in the preceding year — had "settled down to business as a very powerful flowing geyser," with a double period; one eruption occurring every half hour, and projecting water to the height of 30 feet; the main eruption occurring every six or seven days, with long continued action, and a column of nearly 100 feet.

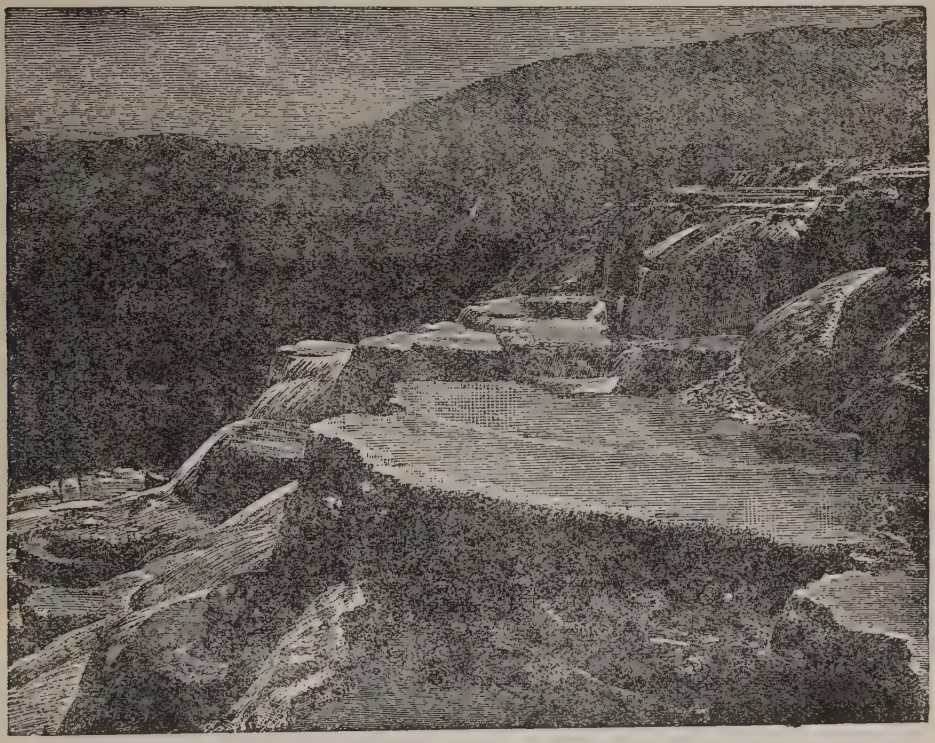
The New Geyser in the same basin is also of quite recent origin. It consists of two fissures in the rock, in which the water boils vigorously. But there is no mound, and the rocks of the fissure are just beginning to get a coating of the silicious geyserite deposited from the water, so that it cannot long have been spouting. Again, in the Grotto Geyser—in the Upper Geyser Basin of Fire Hole River—the main or larger crater is hollowed into fantastic arches, beneath which are the grotto-like cavities from which it is named, which act as lateral orifices for the escape of water during an eruption. It plays several times in the course of the twenty-four hours, and sends a column of water sixty feet high, the eruption lasting an hour. As yet, however, the force of the water has not been sufficient, or of sufficiently long duration, to break through the arches covering the basin or crater. The Excelsior--claimed to be the largest of its order, which sent water nearly 300 feet into

the air at intervals of about five hours, and of such volume as to wash away bridges over small streams below—was not, until comparatively recent years, known as a specially powerful geyser. But if it had for a time waned in importance, its immense crater, 330 feet in length and 200 feet at the widest part, shows that at a still earlier date it was a gigantic fountain. In this deep pit, when the breeze wafted aside the clouds of steam constantly arising from its surface, the water could be seen seething 15 or 20 feet below the surrounding level. Yet into the cauldron of boiling water a little stream of cold water, from the melting snow of the uplands, ran unceasingly. Since 1888 this great geyser has been inactive.

The Castle Geyser is so named on account of the fancied resemblance which its mound of white and grey deposit presents to the ruins of a feudal keep, the crater itself being placed on a cone or turret, which has a somewhat imposing appearance compared with the other geysers in the neighborhood. It throws a column usually about fifty or sixty feet high, at intervals of two or three hours, but sometimes the discharge shoots up much higher.

The Giant, in the Upper Geyser Basin, has a peculiar crater, which has been likened to the stump of a hollow sycamore tree of gigantic proportions, whose top has been wrenched off by a storm. This curious cup is broken down at one side, as though it had been torn away during an eruption of more than ordinary violence, and on this side the visitor is able to look into the crater, if he can contrive to avoid the jets which are constantly spouted from it. The periods of rest which it takes are varied, an eruption often not occurring for several days at a time; yet when it breaks out it continues playing for more than three hours, with a volume of water reaching a height of from 130 to 140 feet. In the interval little spouts are constantly in progess. Mr. Stanley saw one eruption

which he calculated to have shot a column of water to the height of more than 200 feet. At first it seemed as though the geyser was only making a feint, the discharge which preceded the great one being merely repeated several times, followed by a cessation both of the rumbling noises and of the ejection of water. But



THE FAMOUS TERRACES OF YELLOWSTONE NATIONAL PARK

soon, after a premonitory cloud of steam, the geyser began to work in earnest, the column discharged rising higher and higher, until it reached the altitude mentioned.

"At first it appeared to labor in raising the immense volume, which seemed loath to start on its heavenward tour; but it was with perfect ease that the stupendous column was held to its place,

the water breaking into jets and returning in glittering showers to the basin. The steam ascended in dense volumes for thousands of feet, when it was freighted on the wings of the winds and borne away in clouds. The fearful rumble and confusion attending it were as the sound of distant artillery, the rushing of many horses to battle, or the roar of a fearful tornado. It commenced to act at 2 P. M., and continued for an hour and a half, the latter part of which it emitted little else than steam, rushing upward from its chambers below, of which, if controlled, there was enough to run an engine of wonderful power. The waving to and fro of such a gigantic fountain, when the column is at its height,

'Tinselled o'er in robes of varying hues,'

and glistening in the bright sunlight, which adorns it with the glowing colors of many a gorgeous rainbow, affords a spectacle so wonderful and grandly magnificent, so overwhelming to the mind, that the ablest attempt at description gives the reader who has never witnessed such a display but a feeble idea of its glory."

A DESCRIPTION OF THE GEYSER AT WORK

The only other geysers in this remarkable geyserland which we can spare room to notice are those known as the Giantess, the Beehive, and the Grand. The Giantess sends a column of water to the height of 250 feet. An eruption is usually divided into three periods—two preliminary efforts and a final one, divided from each other by intervals of between one and two hours, while the intervals of discharge are very long. Sometimes it does not play for several weeks. The Beehive, which is 400 feet from the Giantess, gets its name from the peculiar beehive-like cone which it has formed. The eruption is also almost unique. It is heralded by a slight escape of steam, which is followed by a column of steam

and water, shooting to the height of over 200 feet. The column is somewhat fan-shaped, but it does not fall in rain, the spray being evaporated and carried off as steam—if, indeed, there is not more steam than water in the column. The duration of the discharge is between four and five minutes, and the interval between two eruptions from twenty-one to twenty-five hours.

The Grand is one of the most important in the Upper Geyser basin. Yet, unlike the Grotto, the Giant, or the Old Faithful, —so called from its frequent and regular eruptions—it has no raised cone or crater, and a much less cavernous bowl than the Giantess and other geysers. The column discharged ascends to the height of from eighty to two hundred feet, and the eruptions last from fifteen minutes to three-quarters of an hour, with intervals on an average of from seven to twenty hours. This fountain is apparently very irregular in its action, though it is just possible that when the Yellowstone geysers have been more consecutively studied, it will be found that these seeming irregularities depend on the varying supplies of water at different times of the year.

THE MAMMOTH HOT SPRINGS

The marvellous phenomena of the Yellowstone region are not confined to geyser action, hot springs of steady flow being, as above stated, exceedingly numerous. Of these the most striking are those known as the Mammoth Hot Springs, whose waters find their way through underground passages, finally flowing from an opening as the "Boiling River," which empties into the Gardiner River.

These springs are marvels of beauty. Their terraced bowls, adorned with delicate fret-work, are among the finest specimens of Nature's handiwork in the world, and the colored waters themselves are startling in their brilliancy. Red, pink, black, canary, green,

saffron, blue, chocolate, and all their intermediate gradations are found here in exquisite harmony. The springs rise in terraces of various heights and widths, having intermingled with their delicate shades chalk-like cliffs, soft and crumbly, these latter being the remains of springs from which the life and beauty have departed. The great spring is the largest in the country, the water flowing through three openings into a basin forty feet long by twenty-five feet wide. From this the hot mineral waters drip over into lower basins, of gracefully curved and scalloped outline, the minerals deposited on the lips of the basin forming stalagmites of variegated hue, yielding a brilliant and beautiful effect. The terraced basins bear a close resemblance to the former New Zealand pink and white terraces, and since the annihilation of the latter are the most charming examples in existence of this rare form of Nature's artistic handiwork.

* There are 512 pages in this volume. The sixty-four pages of half tone illustrations should be added to the last folio number (448) indicated, giving a total of 512 pages.

Date Due

Demco 38-297

828
.M6

36935

DG
828
.M6

36935

Morris

Morris's Story of the Great Earth-
quake of 1908

Pearlman Memorial Library
Central Bible College
Springfield, Missouri

CENTRAL BIBLE COLLEGE
DG828.M6
Morris's story of the great earthquake of 1908 : and
3 2225 00045788 2